48AJ,AK,AW,AY020-060
with Reciprocating Compressor
48EJ,EK,EW,EY024-068
Single Package Rooftop Units
Electric Cooling/Gas Heating

Installation, Start-Up and Service Instructions

CONTENTS

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform the basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguishers available for all brazing operations.

⚠ WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

⚠ WARNING

1. Improper installation, adjustment, alteration, service, or maintenance can cause property damage, personal injury, or loss of life. Refer to the User's Information Manual provided with this unit for more details.
2. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

What to do if you smell gas:

1. DO NOT try to light any appliance.
2. DO NOT touch any electrical switch, or use any phone in your building.
3. IMMEDIATELY call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
4. If you cannot reach your gas supplier, call the fire department.

⚠ WARNING

Disconnect gas piping from unit when pressure testing at pressure greater than 0.5 psig. Pressures greater than 0.5 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it *must* be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, a unit connected to such piping must be isolated by closing the manual gas valve(s).

INSTALLATION

Step 1 — Provide Unit Support

⚠ CAUTION

1. All panels must be in place when rigging.
2. Unit is not designed for handling by fork truck.

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ROOF CURB — For vertical discharge units, assemble or install accessory roof curb in accordance with instructions shipped with this accessory. See Fig. 1-4. Install insulation, cant strips, roofing, and counter flashing as shown. Ductwork can be installed to roof curb before unit is set in place. Curb should be level. This is necessary to permit unit drain to function properly. Unit leveling tolerance is shown in Fig. 1-3. Refer to Accessory Roof Curb Installation Instructions for additional information as required. When accessory roof curb is used, unit may be installed on class A, B, or C roof covering material.

IMPORTANT: The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasket with the roof curb as shown in Fig. 1-3. Improperly applied gasket can also result in air leaks and poor unit performance.

ALTERNATE UNIT SUPPORT — When the preferred curb or slab mount cannot be used, support unit with sleepers on perimeter, using unit curb support area. If sleepers cannot be used, support long sides of unit (refer to Fig. 5-16) with a minimum number of 4-in. x 4-in. pads spaced as follows: 48AJ,AK,AW,AY020-030 and 48EJ,EK,EW,EY024-034 units require 3 pads on each side; 48AJ,AK,AW,AY035-050 and 48EJ,EK,EW,EY038-048 units require 4 pads on each side; 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 units require 6 pads on each side. Unit may sag if supported by corners only.

Step 2 — Rig and Place Unit — Inspect unit for transportation damage. See Tables 1A and 1B for physical data. File any claim with transportation agency.

Do not drop unit; keep upright. Use spreader bars over unit to prevent sling or cable damage. Level by using unit frame as a reference; leveling tolerance is shown in Fig. 1-3. See Fig. 17 for additional information. Unit operating weight is shown in Table 2.

NOTE: On retrofit jobs, ductwork may be attached to old unit instead of roof curb. Be careful not to damage ductwork when removing old unit. Attach existing ductwork to roof curb instead of unit.

Four lifting lugs are provided on the unit base rails as shown in Fig. 5-16. Refer to rigging instructions on unit.

POSITIONING — Maintain clearance, per Fig. 5-16, around and above unit to provide minimum distance from combustible materials, proper airflow, and service access.

Do not install unit in an indoor location. Do not locate unit air inlets near exhaust vents or other sources of contaminated air. For proper unit operation, adequate combustion and ventilation air must be provided in accordance with Section 5.3 (Air for Combustion and Ventilation) of the National Fuel Gas Code, ANSI Z223.1 (American National Standards Institute).

Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Locate mechanical draft system flue assembly at least 4 ft from any opening through which combustion products could enter the building, and at least 4 ft from any adjacent building. When unit is located adjacent to public walkways, flue assembly must be at least 7 ft above grade.

ROOF MOUNT — Check building codes for weight distribution requirements. See Fig. 17. Unit operating weight is shown in Table 2.

Step 3 — Field Fabricate Ductwork — Secure all ducts to building structure. Use flexible duct connectors between unit and ducts as required. Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

NOTE: Due to width of the horizontal supply/return ductwork, provisions should be made for servicing of the outdoor air filters (i.e., catwalk over ductwork).

Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier. Outlet grilles must not lie directly below unit discharge. The return duct must have a 90-degree elbow before opening into the building space if the unit is equipped with power exhaust.

To attach ductwork to roof curb, insert duct approximately 10 to 11 in. up into roof curb. Connect ductwork to 14-gage roof curb material with sheet metal screws driven from inside the duct.

⚠ WARNING

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install a 90-degree elbow turn in the supply and return ductwork between the unit and the conditioned space. If a 90-degree elbow cannot be installed, then a grille of sufficient strength and density should be installed to prevent objects from falling into the conditioned space.

Step 4 — Make Unit Duct Connections

48AJ,AK,EJ,EK UNITS — Unit is shipped for through-the-bottom duct connections. Field-fabricated ductwork should be **attached to the roof curb**. Supply and return duct dimensions are shown in Fig. 5-7 and 11-13. Air distribution is shown in Fig. 18 and 19. Refer to installation instructions shipped with roof curb for more information.

48AW,AY,EW,EY UNITS — Remove shipping covers from supply and return air openings. Attach field-supplied ductwork to unit. Connect to the unit with a single duct for **all** supply openings and with a single duct for all return openings. Splitting of the airflow into branch ducts should not be done at the unit. Sufficient duct length should be used prior to branching to ensure the air temperatures are well mixed within the ductwork. See Fig. 8-10 and 14-16 for duct opening dimensions. Secure all ducts to building structure. Air distribution is shown in Fig. 8-10 and 14-16.

Install accessory barometric relief or power exhaust in the field-fabricated return ductwork. Refer to Step 11 — Position Power Exhaust/Barometric Relief Damper Hood section on page 52 for more information.

Instructions continued on page 28.

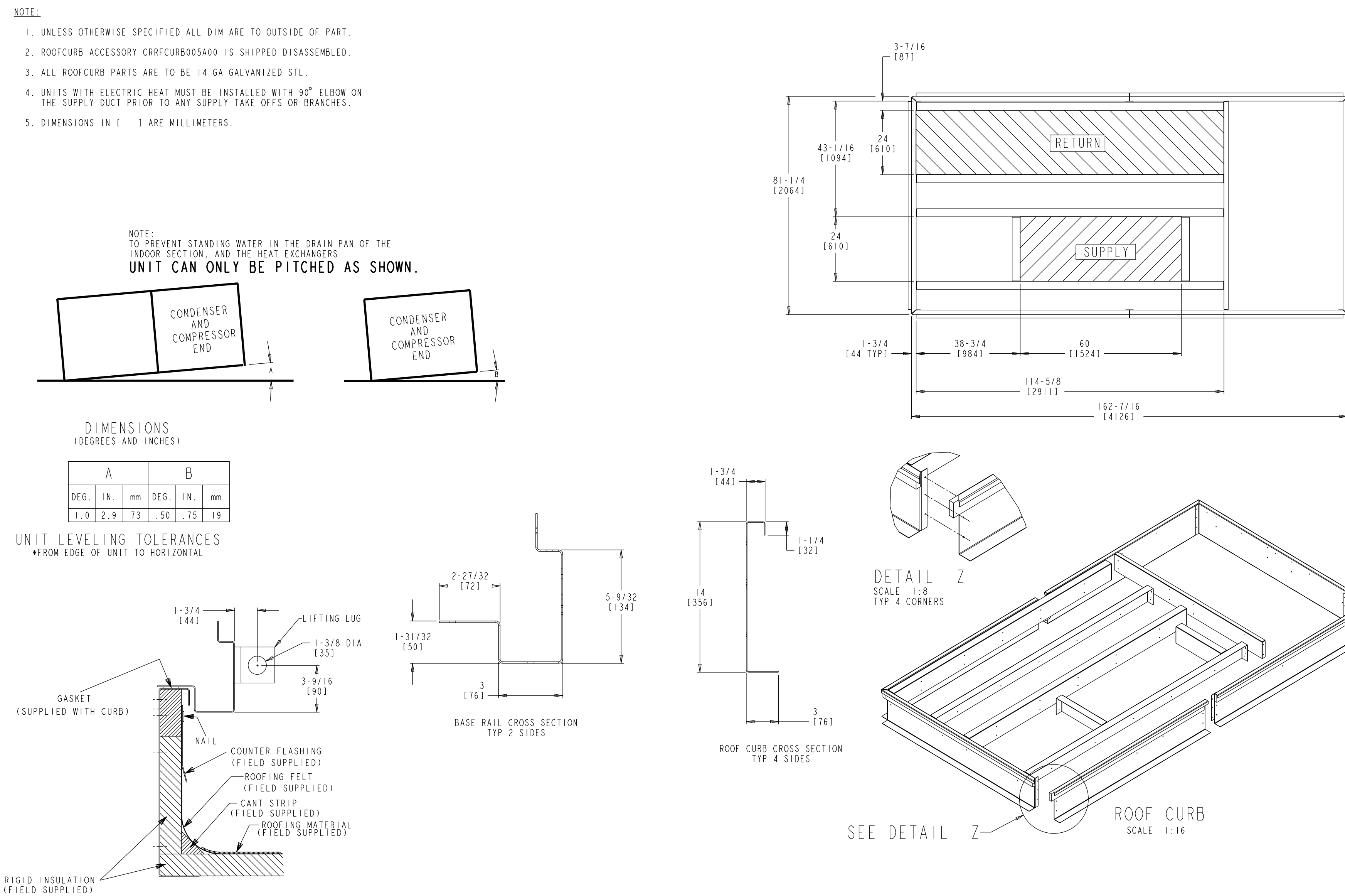
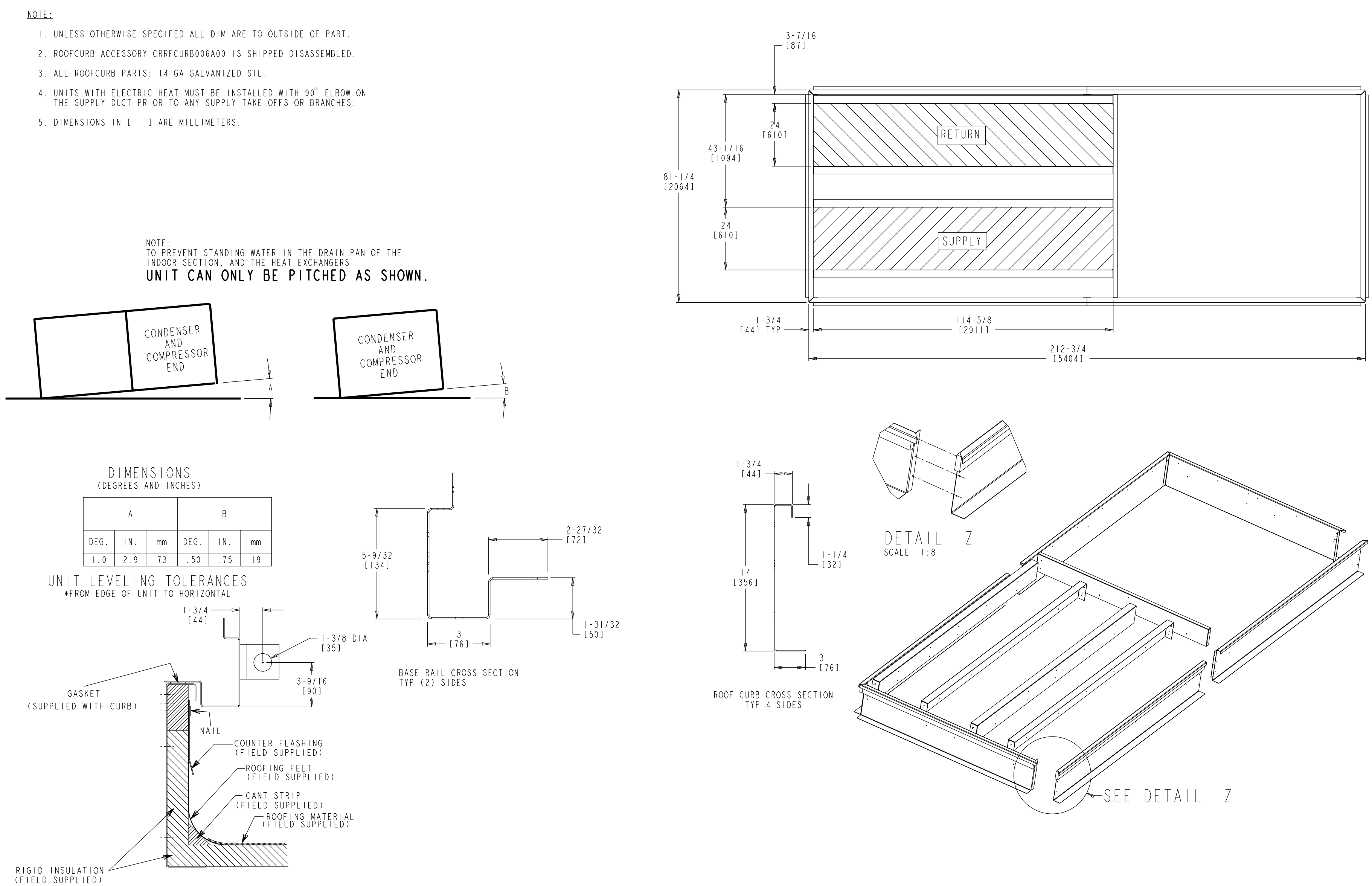
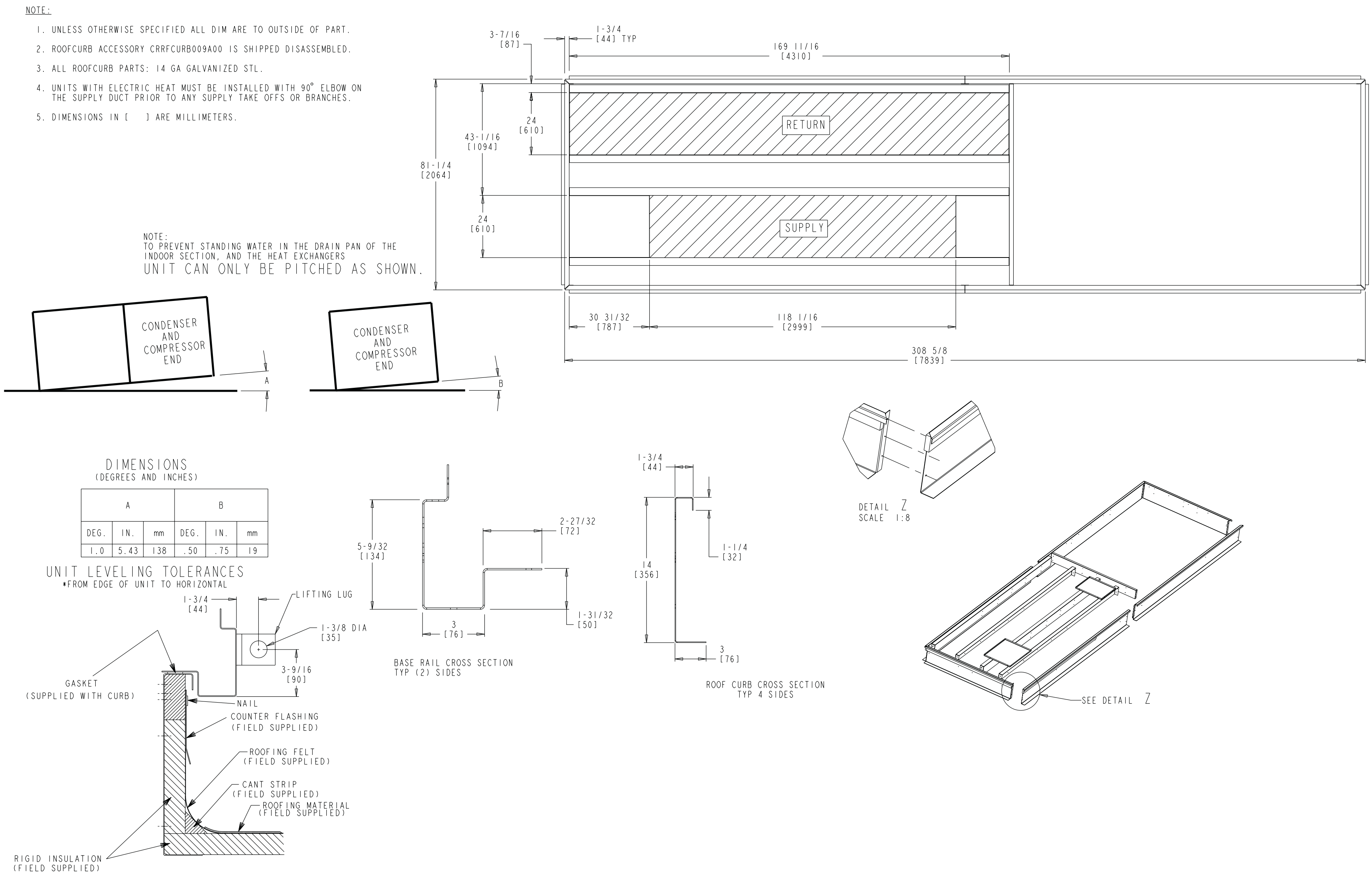


Fig. 1 — Roof Curb — 48AJ,AK020-030 and 48EJ,EK024-034 Units



A			B		
DEG.	IN.	mm	DEG.	IN.	mm
1.0	2.9	73	.50	.75	19

Fig. 2 — Roof Curb — 48AJ,AK034-050 and 48EJ,EK038-048 Units



DIMENSIONS
(DEGREES AND INCHES)

A			B		
DEG.	IN.	mm	DEG.	IN.	mm
1.0	5.43	138	.50	.75	19

Fig. 3 — Roof Curb — 48AJ,AK060 and 48EJ,EK054-068 Units

NOTES:
1. Unless otherwise specified, all dimensions are to outside of part.
2. Seal strip to be placed covering reference holes.
3. Phantom lines represent seal strip. Total length required is 75 linear ft.
4. If existing seal strip around roof curb seems damaged, replace it. Total length required is 62 linear ft.
5. Five crossrails are field located per dimensions shown and secured using self-tapping screws.
6. 48A and 48E series units will overhang existing “DD” or “DF” roof curbs by 2.98″ at indoor motor end and 15.08″ at compressor end.
7. Ductwork (field supplied) must be notched to clear three crossrails.
8. Dimensions in [ ] are millimeters.

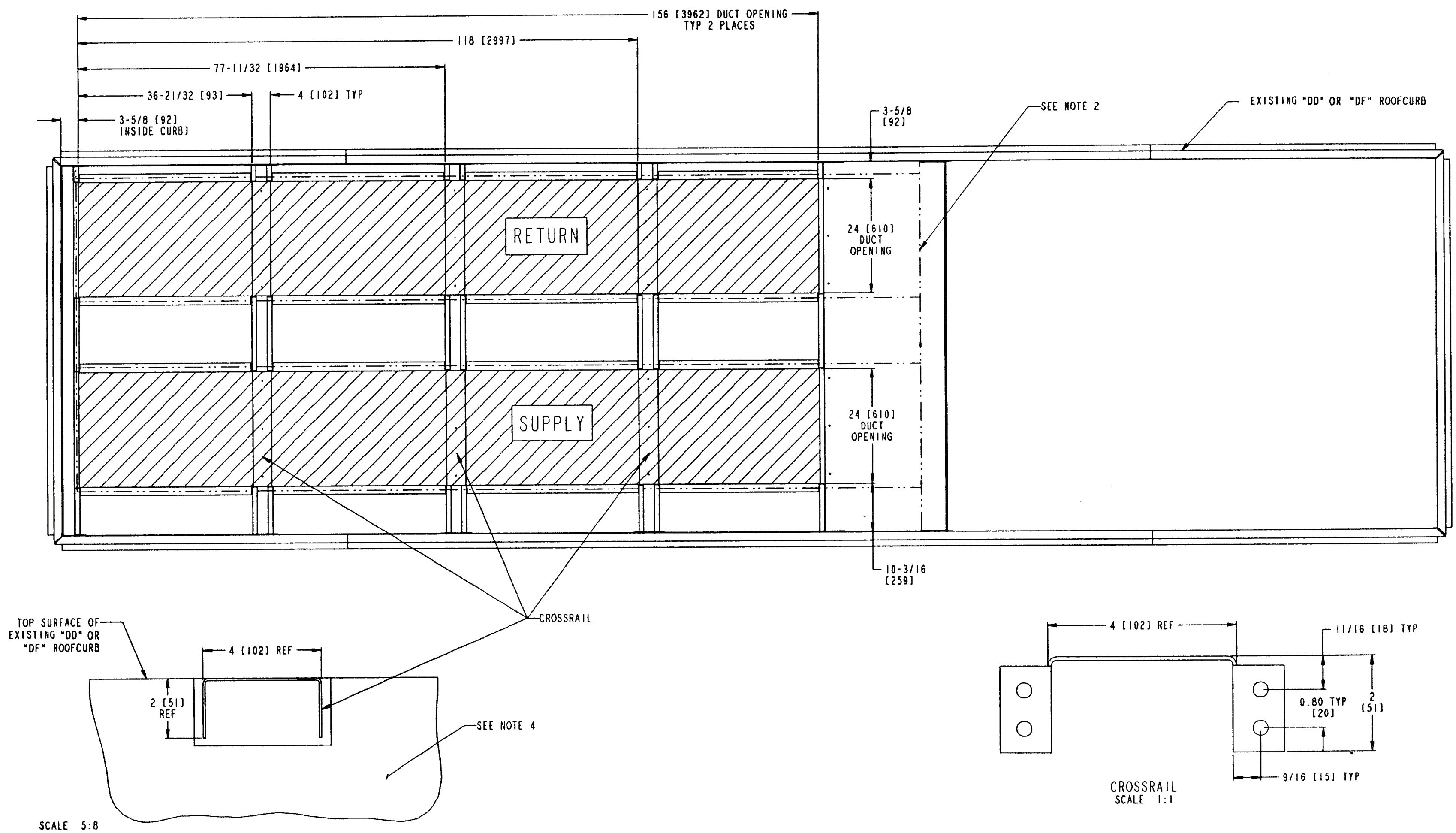


Fig. 4 — Roof Curb Adapter — (48AJ,AK060 and 48EJ,EK054-068 Units on 48DD,DF054-064 Retrofit, Part No. CRRCADPT005A00)

NOTES:
1. Weights include economizer (standard).
2. (Center of Gravity symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 10′-0″ [3048]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Bottom ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts must be supported by cross braces as done on accessory roof curb.
6. Dimensions are in inches [mm].

UNIT SIZE	OPERATING WEIGHT* (lbs)	A (ft-in.)	B (ft-in.)	CORNER WEIGHT (lbs)			
				1	2	3	4
48AJ/AK (Low Heat) 020	5142	6- $0^3/_8$	3-$6^3/_{16}$	1082	1174	1502	1384
48AJ (High Heat) 020	5222	6- $1^5/_{16}$	3-$6^{11}/_{16}$	1126	1194	1494	1408
48AJ/AK (Low Heat) 025	5228	5- $9^5/_8$	3-8	1103	1103	1511	1511
48AJ (High Heat) 025	5308	5-$10^3/_{32}$	3-$8^5/_{16}$	1135	1120	1516	1537
48AJ/AK (Low Heat) 027	5325	5- $9^5/_8$	3-8	1123	1123	1539	1539
48AJ (High Heat) 027	5405	5-$10^3/_{32}$	3-$8^5/_{16}$	1156	1140	1544	1565
48AJ/AK (Low Heat) 030	5325	5- $9^5/_8$	3-8	1123	1123	1539	1539
48AJ (High Heat) 030	5405	5-$10^3/_{32}$	3-$8^5/_{16}$	1156	1140	1544	1565

UNIT SIZE	OPERATING WEIGHT* (kg)	A (mm)	B (mm)	CORNER WEIGHT (kg)			
				1	2	3	4
48AJ/AK (Low Heat) 020	2332	1839	1072	491	533	681	628
48AJ (High Heat) 020	2369	1862	1085	511	542	678	639
48AJ/AK (Low Heat) 025	2371	1768	1118	500	500	686	686
48AJ (High Heat) 025	2408	1781	1125	515	508	688	697
48AJ/AK (Low Heat) 027	2415	1768	1118	509	509	698	698
48AJ (High Heat) 027	2452	1781	1125	524	517	700	710
48AJ/AK (Low Heat) 030	2415	1768	1118	509	509	698	698
48AJ (High Heat) 030	2452	1781	1125	524	517	700	710

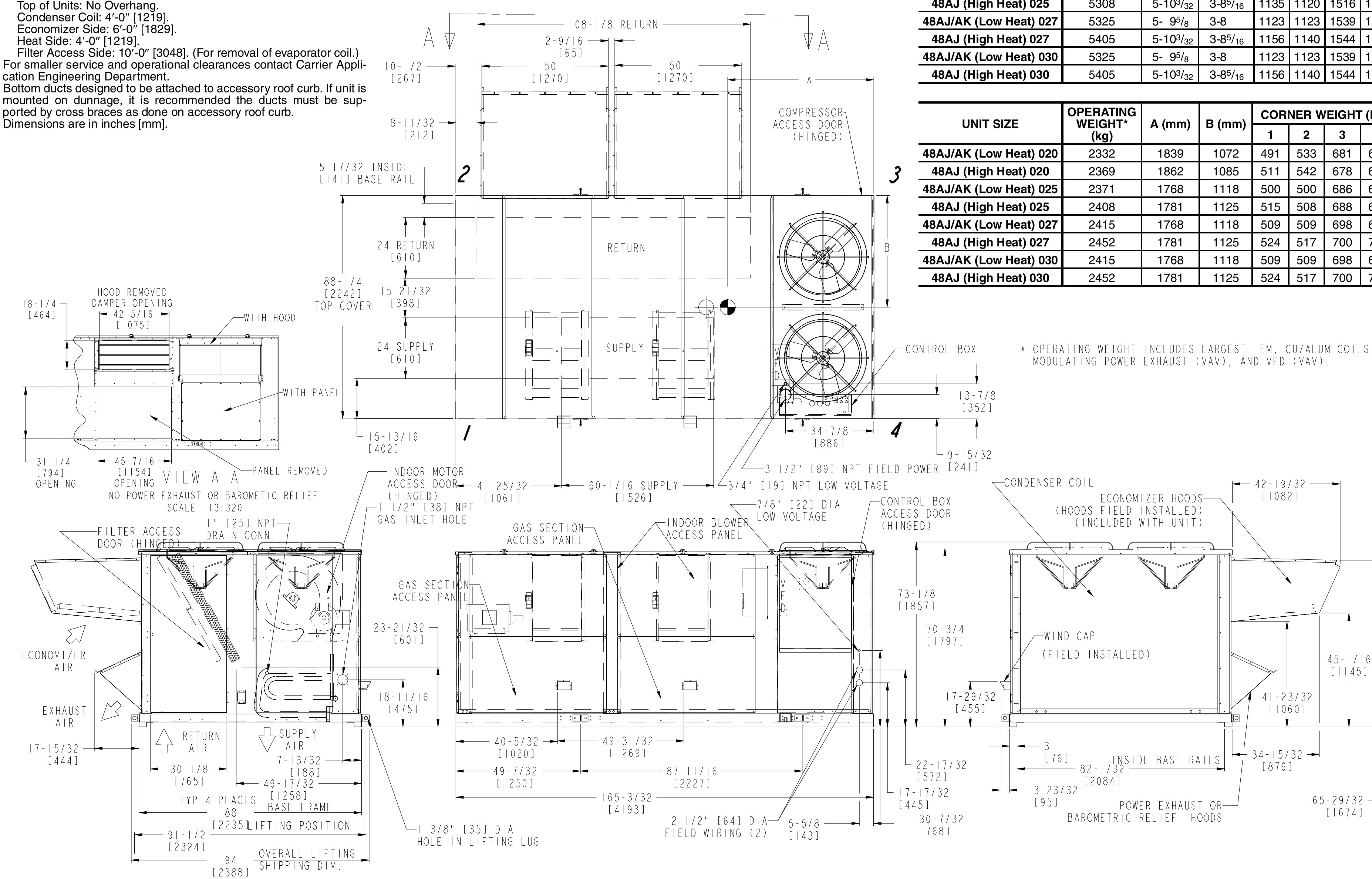


Fig. 5 — Base Unit Dimensions — 48AJ,AK020-030

NOTES:
1. Weights include economizer (standard).
2. (Center of Gravity symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
 Adjacent Units: 15′-0″ [4572].
 Top of Units: No Overhang.
 Condenser Coil: 4′-0″ [1219].
 Economizer Side: 6′-0″ [1829].
 Heat Side: 4′-0″ [1219].
 Filter Access Side: 10′-0″ [3048]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Bottom ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts must be supported by cross braces as done on accessory roof curb.
6. Dimensions are in inches [mm].

UNIT SIZE	OPERATING WEIGHT* (lbs)	A (ft-in.)	B (ft-in.)	CORNER WEIGHT (lbs)			
				1	2	3	4
48AJ/AK (Low Heat) 035	6004	7-8 11/16	3-10 7/8	1380	1209	1595	1820
48AJ (High Heat) 035	6164	7-10 1/8	3-11 3/16	1447	1251	1607	1859
48AJ/AK (Low Heat) 040	6514	7-5 5/16	3-10 7/8	1442	1264	1779	2030
48AJ (High Heat) 040	6674	7-6 13/16	3-11 3/16	1512	1307	1787	2068
48AJ/AK (Low Heat) 050	6725	7-3 11/16	3-10 1/2	1449	1294	1878	2104
48AJ (High Heat) 050	6885	7-5 3/16	3-10 13/16	1519	1337	1886	2142

UNIT SIZE	OPERATING WEIGHT* (kg)	A (mm)	B (mm)	CORNER WEIGHT (kg)			
				1	2	3	4
48AJ/AK (Low Heat) 035	2723	2355	1191	626	548	723	826
48AJ (High Heat) 035	2796	2390	1199	656	567	729	843
48AJ/AK (Low Heat) 040	2955	2268	1191	654	573	807	921
48AJ (High Heat) 040	3027	2306	1199	686	593	811	938
48AJ/AK (Low Heat) 050	3050	2228	1181	657	587	852	954
48AJ (High Heat) 050	3123	2266	1189	689	607	856	972

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).

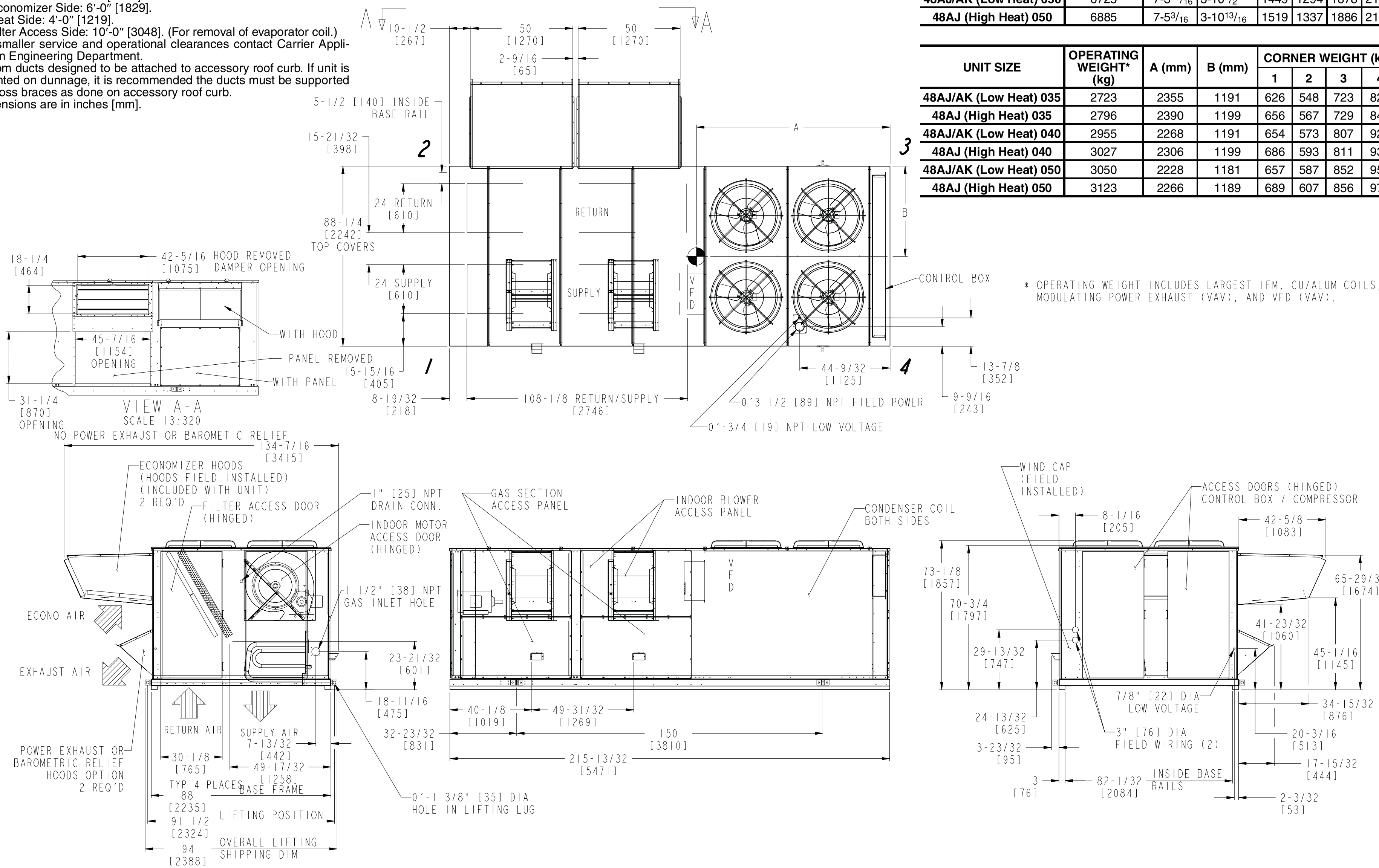


Fig. 6 — Base Unit Dimensions — 48AJ,AK035-050

NOTES:
1. Weights include economizer (standard).
2. (Center of Gravity symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 15′-0″ [4572]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Bottom ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts must be supported by cross braces as done on accessory roof curb.
6. Base unit weights include outdoor air hoods and filters (indoor fan motor is not included). Add indoor motor, FIOPs and accessories for total operating weight.
7. VAV motor weights include indoor motor, VFD, compressor electric unloaders, VFD transducer and associated wiring.
8. Dimensions are in inches [mm].

BASE UNIT WEIGHTS (See Note 6) lbs (kg)	
	060
48AJD/AKD	8930 (4051)
48AJE	9170 (4159)

UNIT SIZE	CENTER OF GRAVITY				% OF TOTAL WEIGHT AT EACH CORNER			
	ft-in.		Millimeters					
	A	B	A	B	1	2	3	4
48AJD/AKD060	10-7 11/16	3-10 19/32	3242	1184	21.7	19.3	27.7	31.2
48AJE060	11-2 11/16	4-19/32	3422	1235	23.9	19.4	25.4	31.3

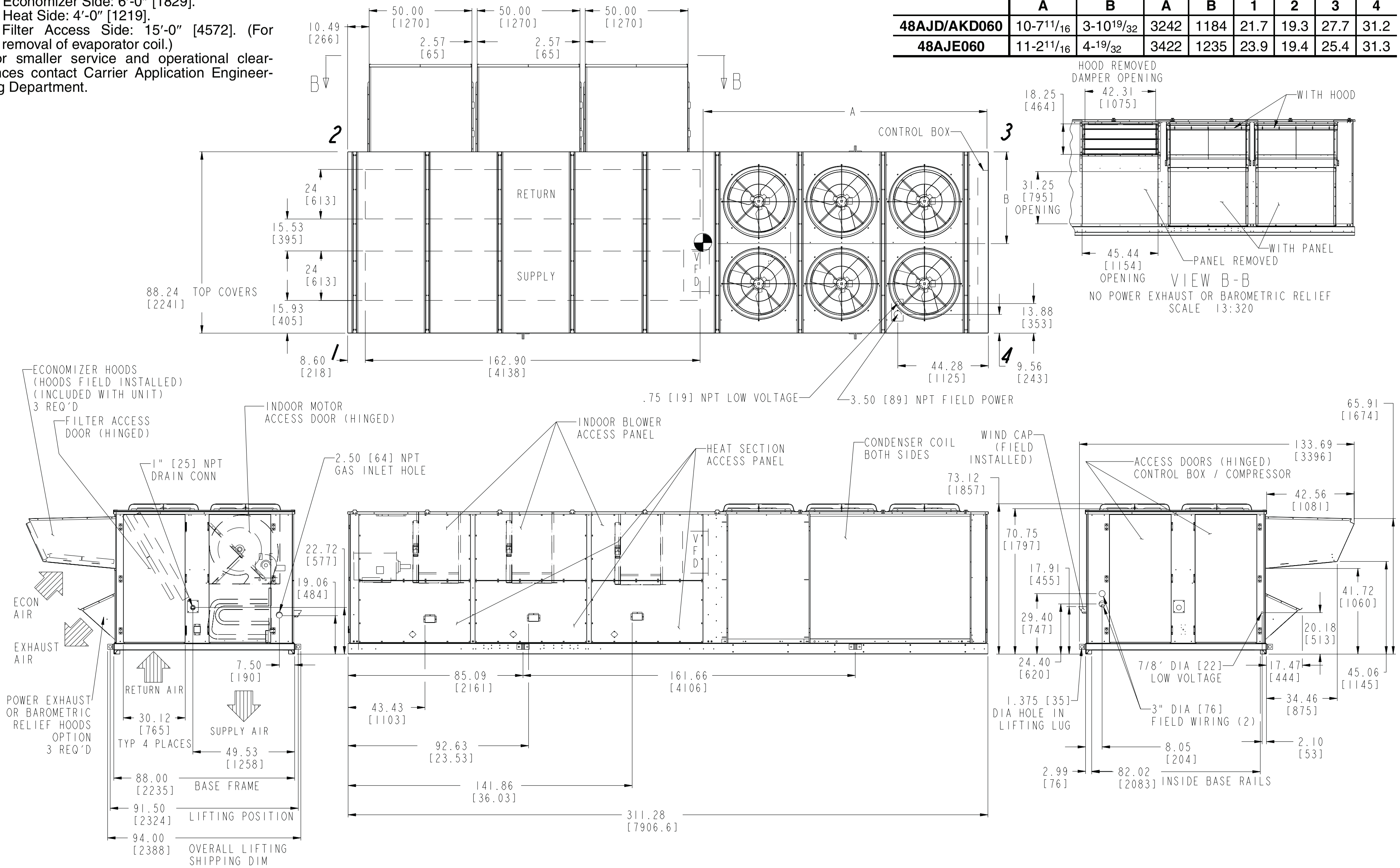


Fig. 7 — Base Unit Dimensions — 48AJ,AK060

NOTES:
1. Weights include economizer (standard).
2. (Center of Gravity symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
   Min Clearances to be:
   - Adjacent Units: 15′-0″ [4572].
   - Top of Units: No Overhang.
   - Condenser Coil: 4′-0″ [1219].
   - Economizer Side: 6′-0″ [1829].
   - Heat Side: 4′-0″ [1219].
   - Filter Access Side: 10′-0″ [3048]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Dimensions are in inches [mm].

UNIT SIZE	OPERATING WEIGHT* (lbs)	A (ft-in.)	B (ft-in.)	CORNER WEIGHT (lbs)			
				1	2	3	4
48AW/AY (Low Heat) 020	5182	6-0 3/8	3-6 3/16	1090	1183	1514	1395
48AW (High Heat) 020	5262	6-1 5/16	3-6 11/16	1134	1203	1505	1419
48AW/AY (Low Heat) 025	5268	5-9 5/8	3-8	1111	1111	1523	1523
48AW (High Heat) 025	5348	5-10 1/8	3-8 5/16	1144	1128	1527	1548
48AW/AY (Low Heat) 027	5365	5-9 5/8	3-8	1132	1132	1551	1551
48AW (High Heat) 027	5445	5-10 1/8	3-8 5/16	1165	1149	1555	1577
48AW/AY (Low Heat) 030	5365	5-9 5/8	3-8	1132	1132	1551	1551
48AW (High Heat) 030	5445	5-10 1/8	3-8 5/16	1165	1149	1555	1577

UNIT SIZE	OPERATING WEIGHT* (kg)	A (mm)	B (mm)	CORNER WEIGHT (kg)			
				1	2	3	4
48AW/AY (Low Heat) 020	2351	1839	1072	495	537	687	633
48AW (High Heat) 020	2387	1862	1085	515	546	683	644
48AW/AY (Low Heat) 025	2390	1768	1118	504	504	691	691
48AW (High Heat) 025	2426	1781	1125	519	512	693	702
48AW/AY (Low Heat) 027	2434	1768	1118	513	513	704	704
48AW (High Heat) 027	2470	1781	1125	528	521	705	715
48AW/AY (Low Heat) 030	2434	1768	1118	513	513	704	704
48AW (High Heat) 030	2470	1781	1125	528	521	705	715

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).

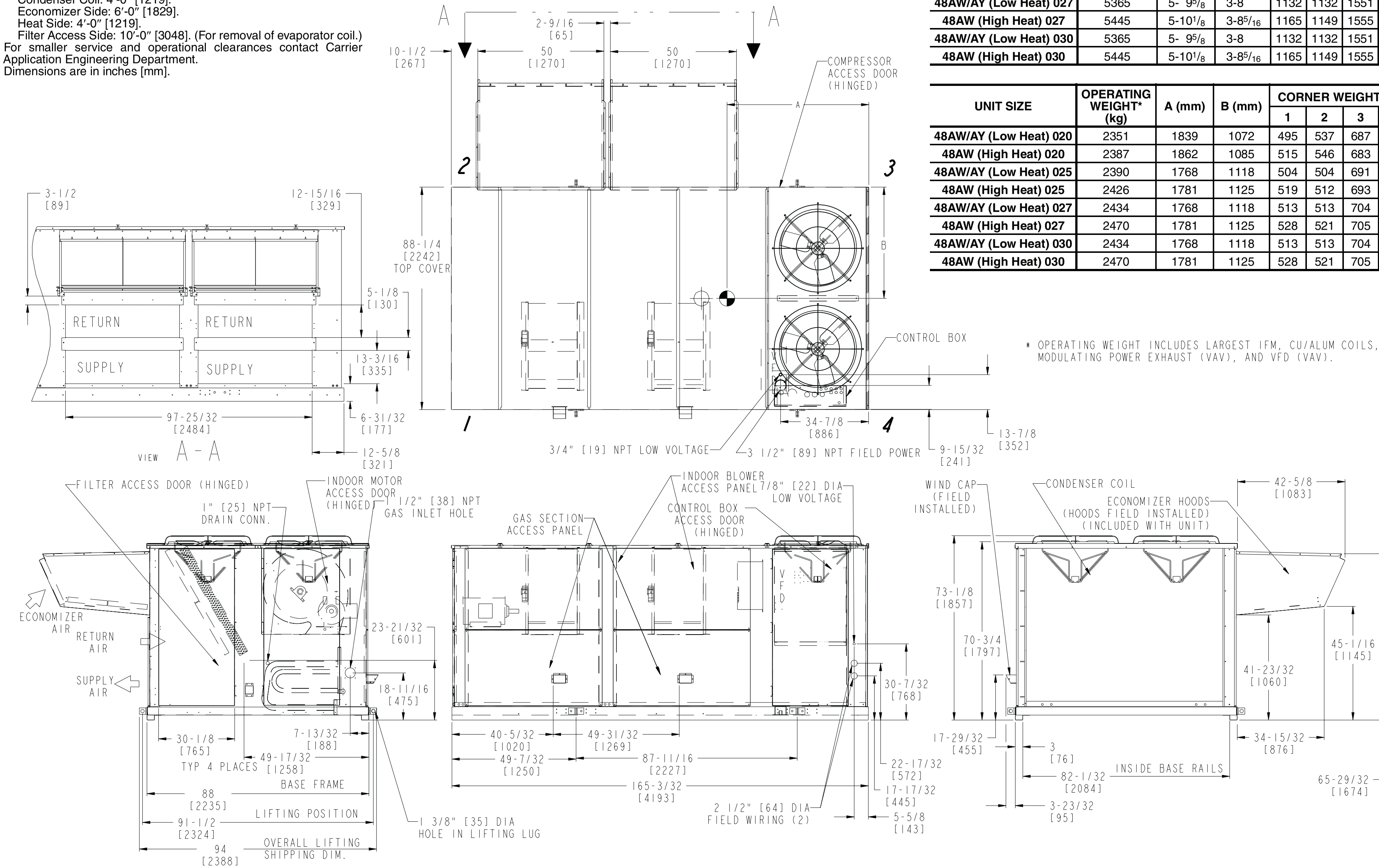


Fig. 8 — Base Unit Dimensions — 48AW,AY020-030

NOTES:
1. Weights include economizer (standard).
2. (Center of Gravity symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
   Min Clearances to be:
   Adjacent Units: 15′-0″ [4572].
   Top of Units: No Overhang.
   Condenser Coil: 4′-0″ [1219].
   Economizer Side: 6′-0″ [1829].
   Heat Side: 4′-0″ [1219].
   Filter Access Side: 10′-0″ [3048]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Dimensions are in inches [mm].

UNIT SIZE	OPERATING WEIGHT* (lbs)	A (ft-in.)	B (ft-in.)	CORNER WEIGHT (lbs)			
				1	2	3	4
48AW/AY (Low Heat) 035	6044	7- 8$^{11}/_{16}$	3-10$^{7}/_{8}$	1389	1217	1606	1832
48AW (High Heat) 035	6204	7-10$^{1}/_{8}$	3-11$^{3}/_{16}$	1456	1259	1617	1871
48AW/AY (Low Heat) 040	6554	7- 3$^{11}/_{16}$	3-10$^{7}/_{8}$	1451	1271	1790	2042
48AW (High Heat) 040	6714	7- 6$^{13}/_{16}$	3-11$^{3}/_{16}$	1521	1315	1798	2080
48AW/AY (Low Heat) 050	6765	7- 3$^{11}/_{16}$	3-10$^{1}/_{2}$	1458	1301	1889	2117
48AW (High Heat) 050	6925	7- 5$^{3}/_{16}$	3-10$^{13}/_{16}$	1528	1345	1897	2155

UNIT SIZE	OPERATING WEIGHT* (kg)	A (mm)	B (mm)	CORNER WEIGHT (kg)			
				1	2	3	4
48AW/AY (Low Heat) 035	2741	2355	1191	630	552	728	831
48AW (High Heat) 035	2814	2390	1199	661	571	734	849
48AW/AY (Low Heat) 040	2973	2268	1191	658	577	812	926
48AW (High Heat) 040	3045	2306	1199	690	596	816	944
48AW/AY (Low Heat) 050	3069	2228	1181	661	590	857	960
48AW (High Heat) 050	3141	2266	1189	693	610	860	977

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).

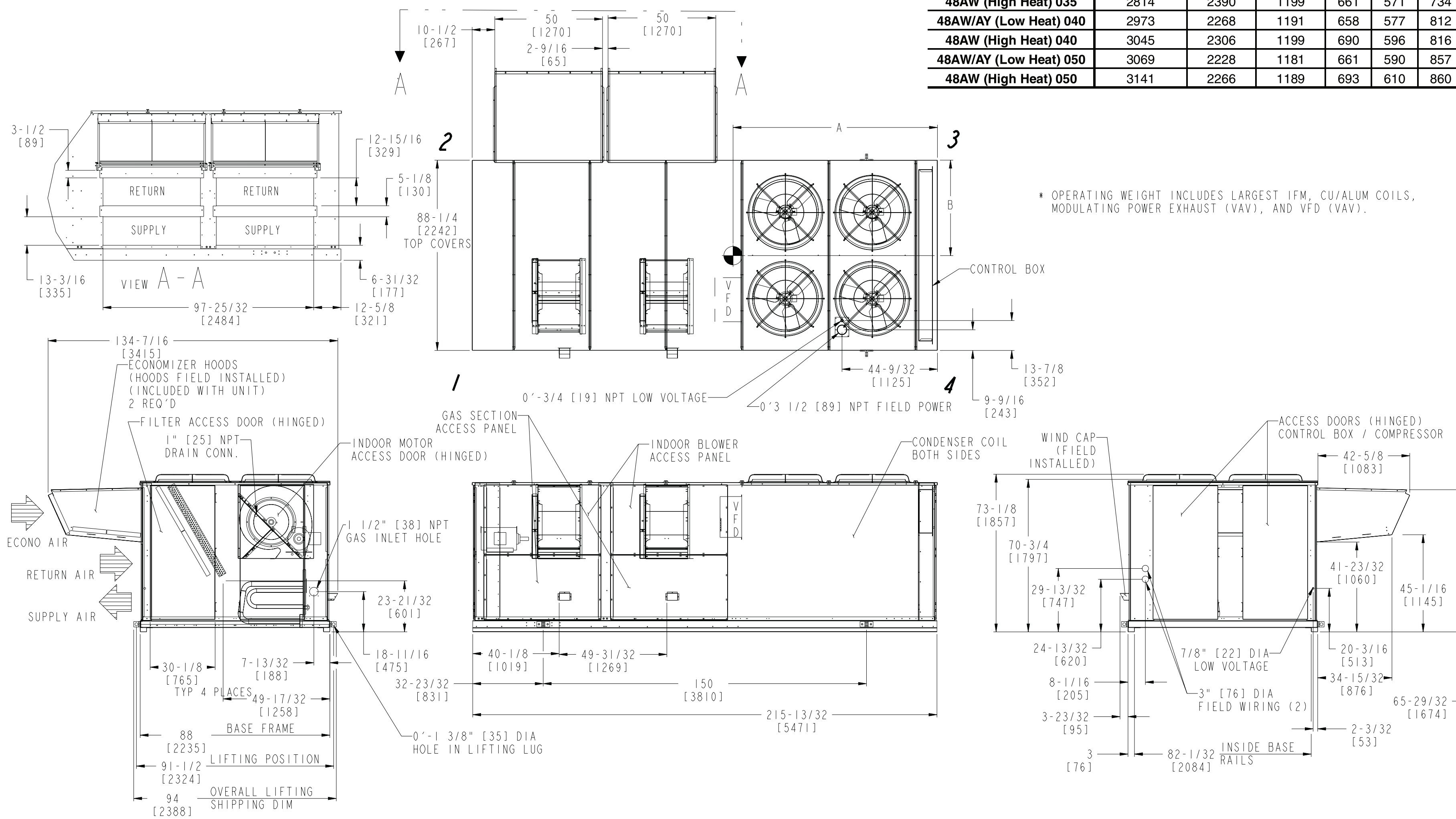


Fig. 9 — Base Unit Dimensions — 48AW,AY035-050

NOTES:
1. Weights include economizer (standard).
2. (symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 15′-0″ [4572]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Base unit weights include outdoor air hoods and filters (indoor fan motor is not included). Add indoor motor, FIOPs and accessories for total operating weight.
6. VAV motor weights include indoor motor, VFD, compressor electric unloaders, VFD transducer and associated wiring.
7. Dimensions are in inches [mm].
8. For side-supply/return applications, a single return and supply ductwork connection is recommended for covering all three return and all three supply openings. The entire area around the duct openings is available for a 1.5″ duct flange attachment.

BASE UNIT WEIGHTS (See Note 6) lbs (kg)	060
48AWD/AYD	8970 (4069)
48AWE	9210 (4178)

UNIT SIZE	CENTER OF GRAVITY				% OF TOTAL WEIGHT AT EACH CORNER			
	ft-in.		Millimeters					
	A	B	A	B	1	2	3	4
48AWD/AYD060	10-7 11/16	3-10 19/32	3242	1184	21.7	19.3	27.7	31.2
48AWE060	11-2 11/16	4-19/32	3422	1235	23.9	19.4	25.4	31.3

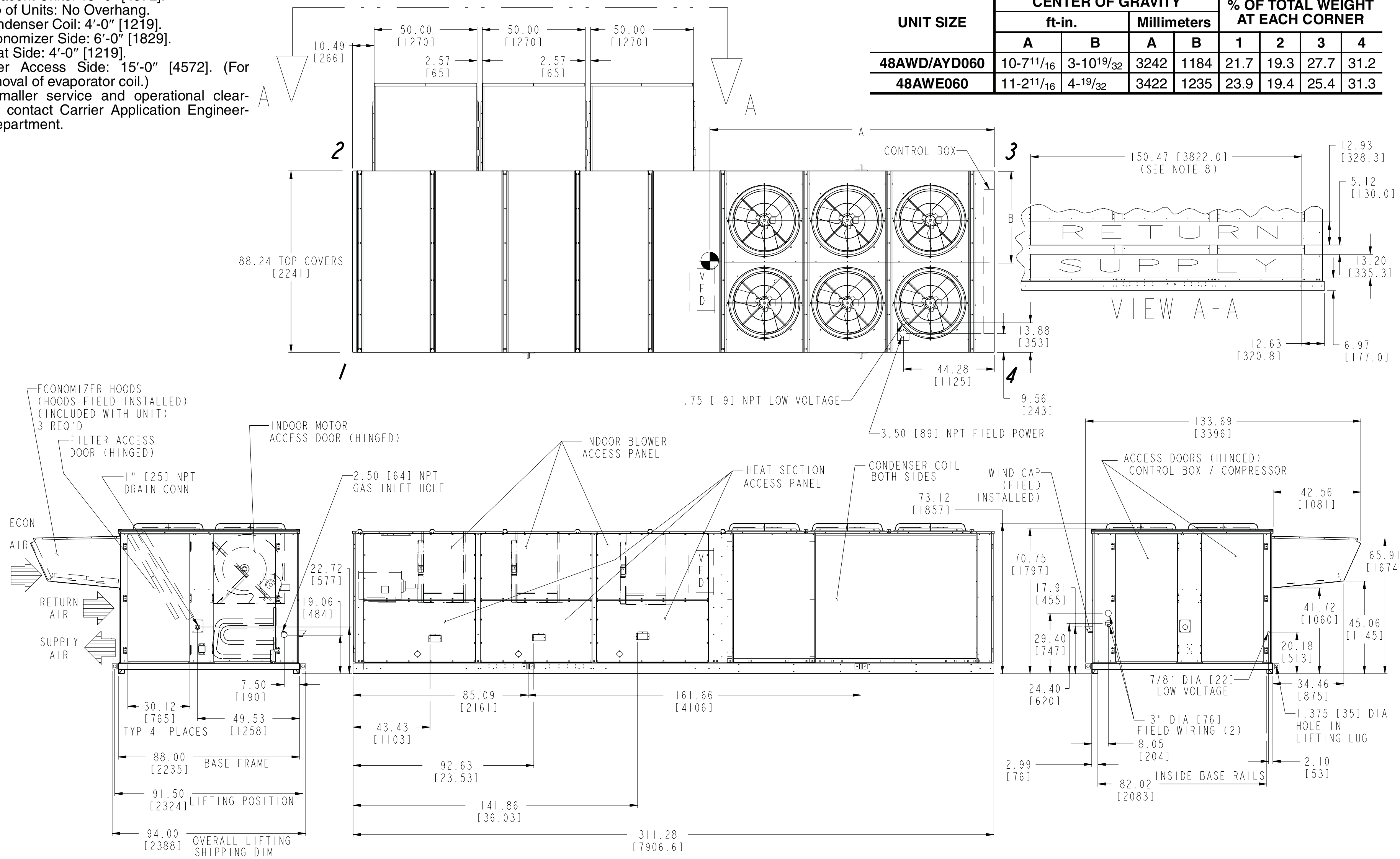


Fig. 10 — Base Unit Dimensions — 48W,AY060

NOTES:
1. Weights include economizer (standard).
2. (Center of Gravity symbol) Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 10′-0″ [3048]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Bottom ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts must be supported by cross braces as done on accessory roof curb.
6. Dimensions are in inches [mm].

UNIT SIZE	OPERATING WEIGHT *	CORNER WEIGHT (LBS)					
		A	B				
	LBS	FT/IN	FT/IN	1	2	3	4
48EJ/EKD024	5097	6′-0 3/8″	3′-6 3/8″	1073	1164	1489	1372
48EJE024	5037	6′-1 5/16″	3′-6 11/16″	1086	1152	1441	1358
48EJ/EKD028	5183	5′-9 5/8″	3′-8″	1093	1093	1498	1498
48EJE028	5123	5′-10 1/8″	3′-8 5/16″	1096	1081	1463	1483
48EJ/EKD030	5259	5′-9 5/8″	3′-8″	1109	1109	1520	1520
48EJE030	5161	5′-10 1/8″	3′-8 5/16″	1104	1089	1474	1494
48EJ/EKD034	5259	5′-9 5/8″	3′-8″	1109	1109	1520	1520
48EJE034	5161	5′-10 1/8″	3′8 5/16″	1104	1089	1474	1494

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).

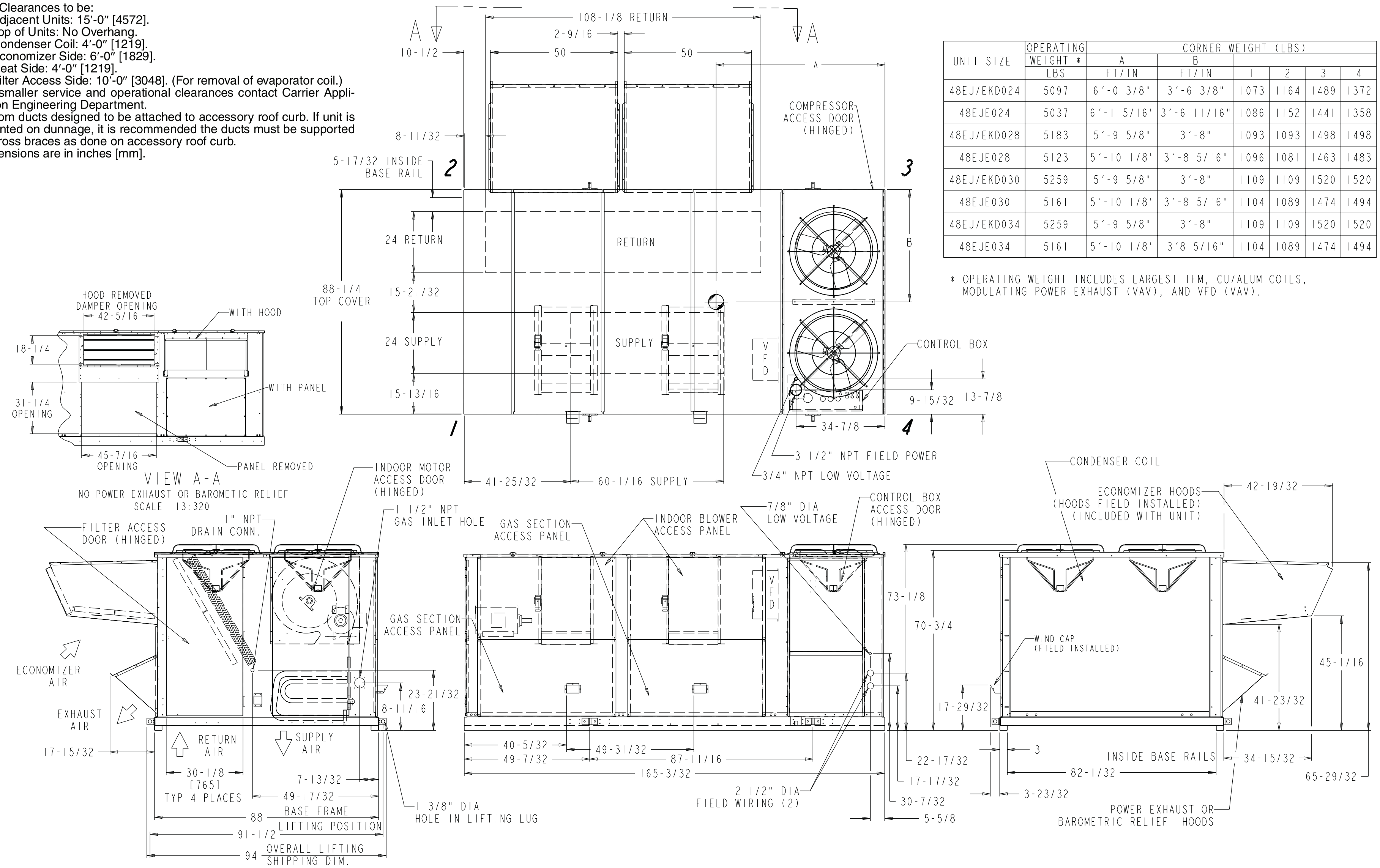


Fig. 11 — Base Unit Dimensions — 48EJ,EK024-034

NOTES:
1. Weights include economizer (standard).
2. Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 10′-0″ [3048]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Bottom ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts must be supported by cross braces as done on accessory roof curb.
6. Dimensions are in inches [mm].

UNIT SIZE	OPERATING WEIGHT * LBS	A FT/IN	B FT/IN	CORNER WEIGHT (LBS) 1	2	3	4
48EJ/EKD038	5898	7′-8 11/16"	3′-10 7/8"	1355	1188	1567	1788
48EJE038	5880	7′-10 1/8"	3′-11 3/16"	1380	1193	1533	1773
48EJ/EKD044	6192	7′-5 5/16"	3′-10 7/8"	1371	1201	1691	1929
48EJE044	6167	7′-6 13/16"	3′-11 3/16"	1389	1201	1658	1918
48EJ/EKD048	6577	7′-3 11/16"	3′-10 1/2"	1418	1265	1836	2058
48EJE048	6494	7′-5 3/16"	3′-10 13/16"	1434	1263	1728	2019

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).

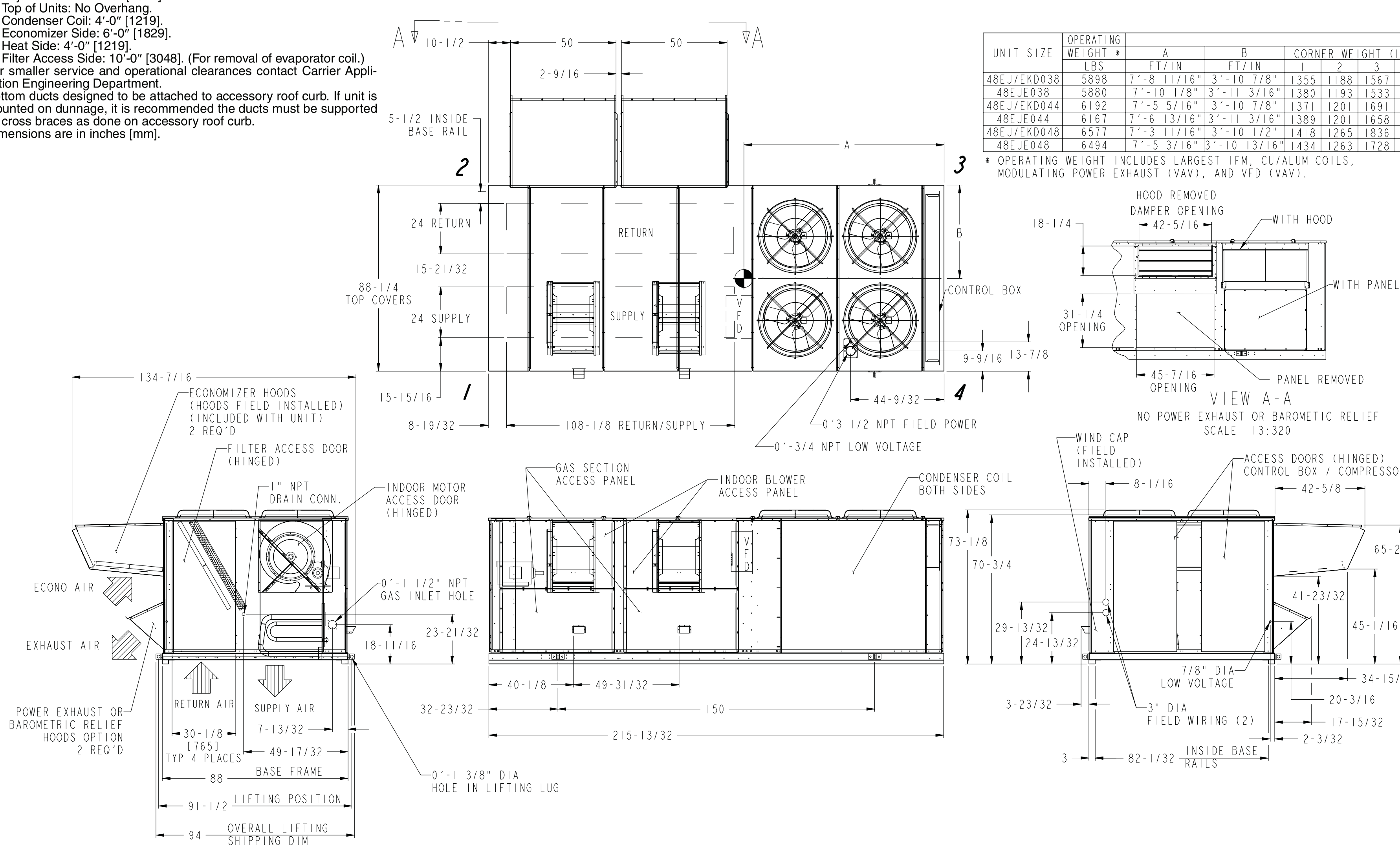


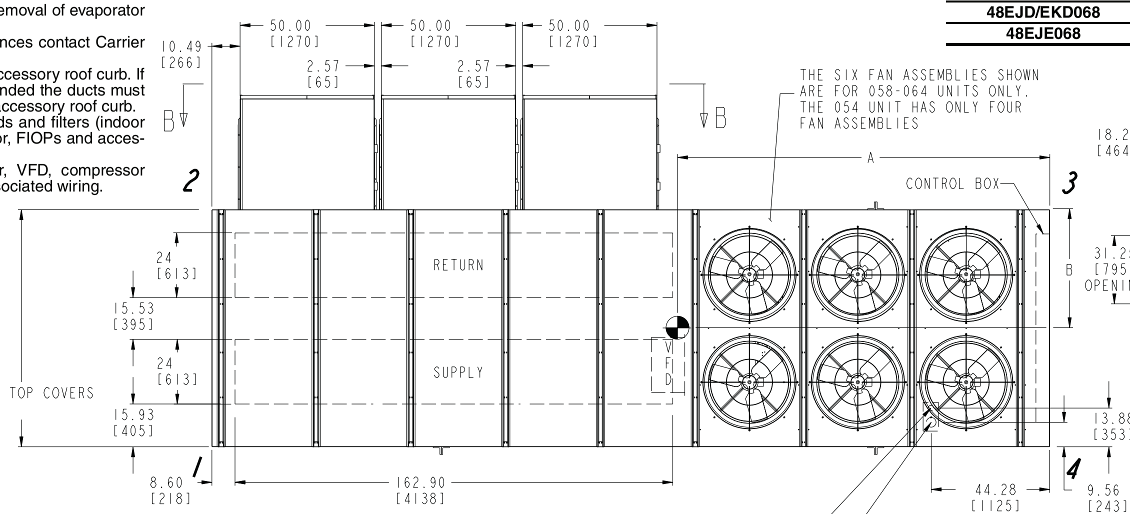
Fig. 12 — Base Unit Dimensions — 48EJ,EK038-048

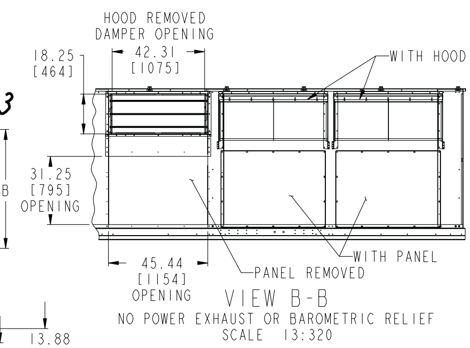
NOTES:
1. Weights include economizer (standard).
2. Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 15′-0″ [4572]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Bottom ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts must be supported by cross braces as done on accessory roof curb.
6. Base unit weights include outdoor air hoods and filters (indoor fan motor is not included). Add indoor motor, FIOPs and accessories for total operating weight.
7. VAV motor weights include indoor motor, VFD, compressor electric unloaders, VFD transducer and associated wiring.
8. Dimensions in are in inches [mm].

BASE UNIT WEIGHTS (See Note 6) lbs (kg)

	054	058	064	068
48EJD/EKD	6805 (3087)	7055 (3200)	7305 (3314)	7480 (3393)
48EJE	7045 (3196)	7295 (3309)	7545 (3422)	7720 (3502)

UNIT SIZE	CENTER OF GRAVITY				% OF TOTAL WEIGHT AT EACH CORNER			
	Inches		Millimeters					
	A	B	A	B	1	2	3	4
48EJD/EKD054	130.9	46.9	3325	1192	22.4	19.6	27.0	30.9
48EJE054	133.8	47.4	3397	1204	23.1	19.8	26.3	30.7
48EJD/EKD058	132.1	47.5	3354	1207	22.9	19.5	26.5	31.1
48EJE058	139.5	49.6	3544	1260	25.3	19.6	24.1	31.1
48EJD/EKD064	125.3	45.2	3181	1149	20.7	19.6	29.1	30.7
48EJE064	132.2	47.2	3359	1199	22.8	19.7	26.7	30.8
48EJD/EKD068	127.7	46.6	3242	1184	21.7	19.3	27.7	31.2
48EJE068	134.7	48.6	3422	1235	23.9	19.4	25.4	31.3





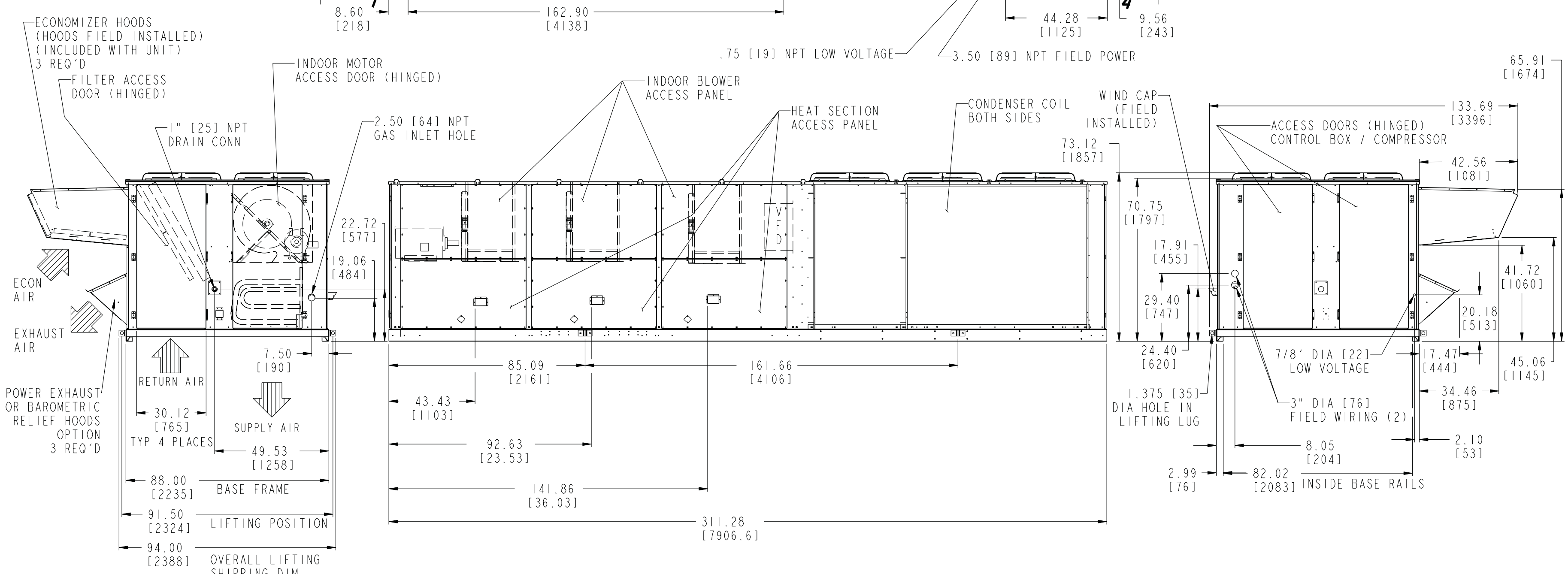
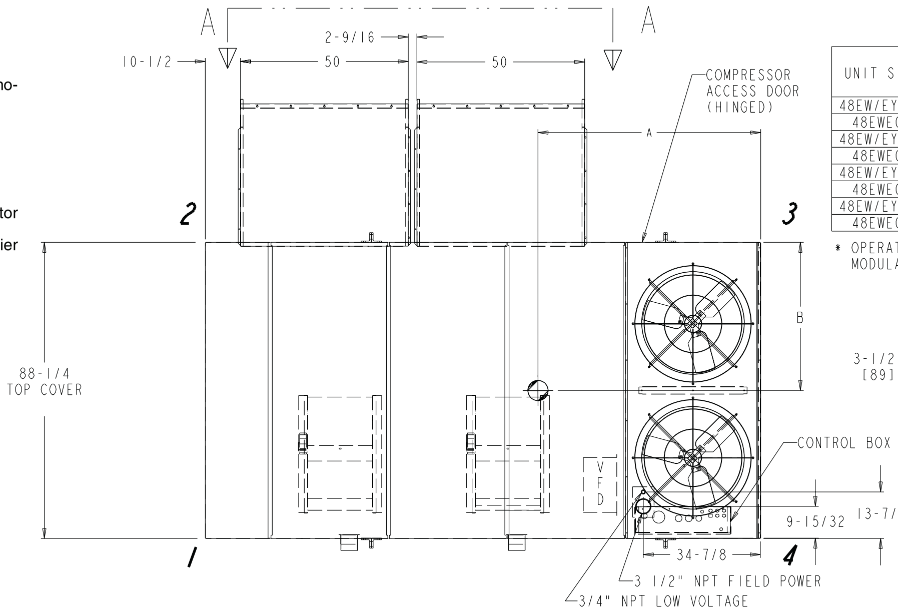


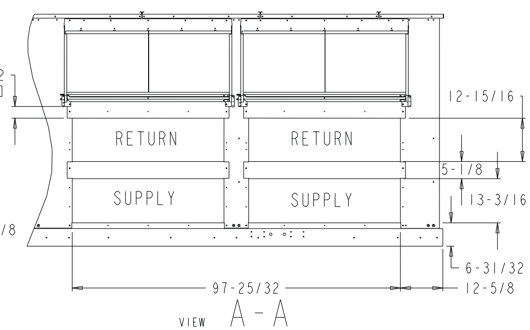
Fig. 13 — Base Unit Dimensions — 48EJ,EK054-068

NOTES:
1. Weights include economizer (standard).
2. ⊕ Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 15′-0″ [4572]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Dimensions in are in inches [mm].



UNIT SIZE	OPERATING WEIGHT *	A	B	CORNER WEIGHT (LBS)			
	LBS	FT/IN	FT/IN	1	2	3	4
48EW/EYD024	5137	6′-0 3/8"	3′-6 3/8"	1081	1173	1500	1383
48EWE024	5077	6′-1 5/16"	3′-6 11/16"	1094	1161	1452	1369
48EW/EYD028	5223	5′-9 5/8"	3′-8"	1102	1102	1510	1510
48EWE028	5163	5′-10 1/8"	3′-8 5/16"	1104	1089	1475	1495
48EW/EYD030	5299	5′-9 5/8"	3′-8"	1118	1118	1532	1532
48EWE030	5201	5′-10 1/8"	3′-8 5/16"	1112	1097	1485	1506
48EW/EYD034	5299	5′-9 5/8"	3′-8"	1118	1118	1532	1532
48EWE034	5201	5′-10 1/8"	3′8 5/16"	1112	1097	1485	1506

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).



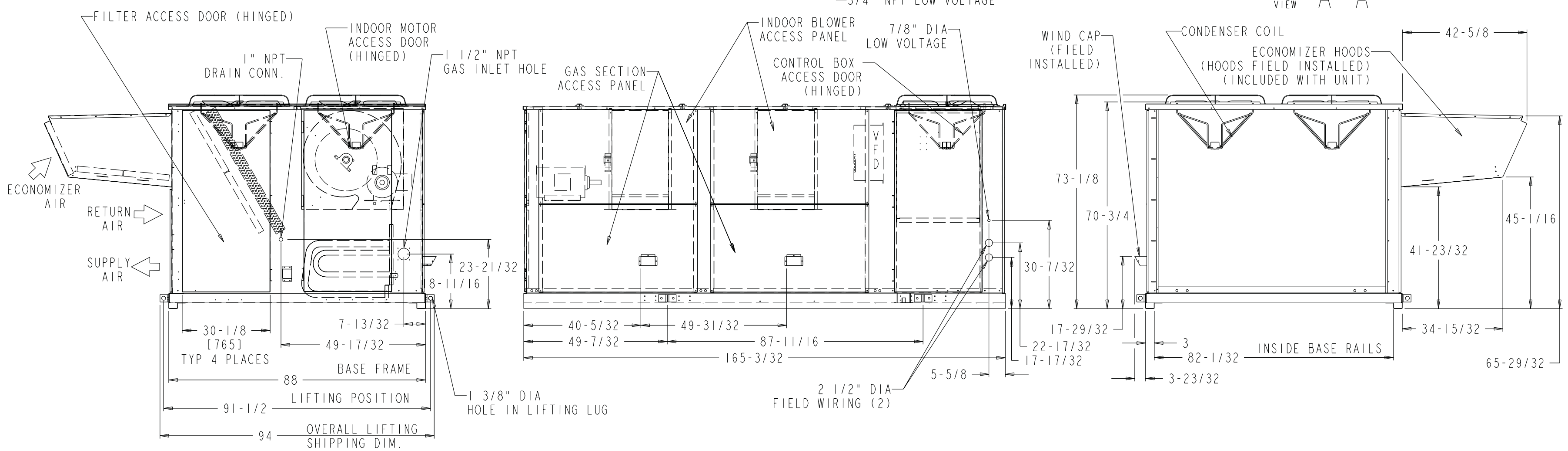
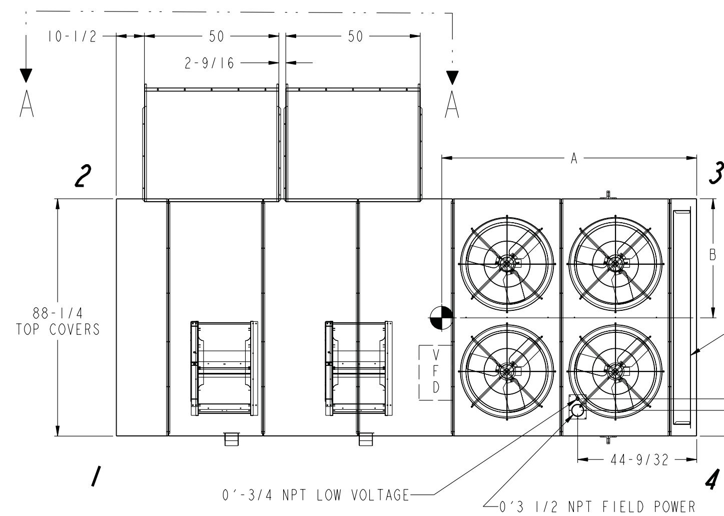


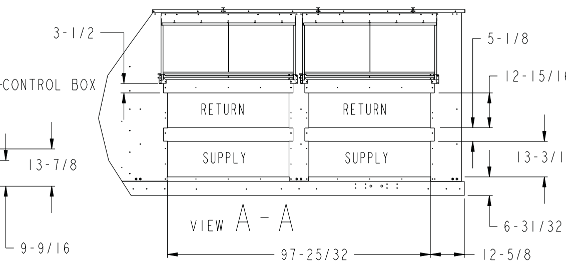
Fig. 14 — Base Unit Dimensions — 48EW,EY024-034

NOTES:
1. Weights include economizer (standard).
2. Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 15′-0″ [4572]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Dimensions in are in inches [mm].



UNIT SIZE	OPERATING WEIGHT *	A	B	CORNER WEIGHT (LBS)			
	LBS	FT/IN	FT/IN	1	2	3	4
48EW/EYD038	5938	7′-8 11/16"	3′-10 7/8"	1364	1196	1578	1800
48EWE038	5920	7′-10 1/8"	3′-11 3/16"	1390	1201	1543	1786
48EW/EYD044	6232	7′-5 5/16"	3′-10 7/8"	1380	1209	1702	1942
48EWE044	6207	7′-6 13/16"	3′-11 3/16"	1406	1215	1662	1928
48EW/EYD048	6617	7′-3 11/16"	3′-10 1/2"	1426	1273	1848	2070
48EWE048	6534	7′-5 3/16"	3′-10 13/16"	1442	1269	1790	2033

* OPERATING WEIGHT INCLUDES LARGEST IFM, CU/ALUM COILS, MODULATING POWER EXHAUST (VAV), AND VFD (VAV).



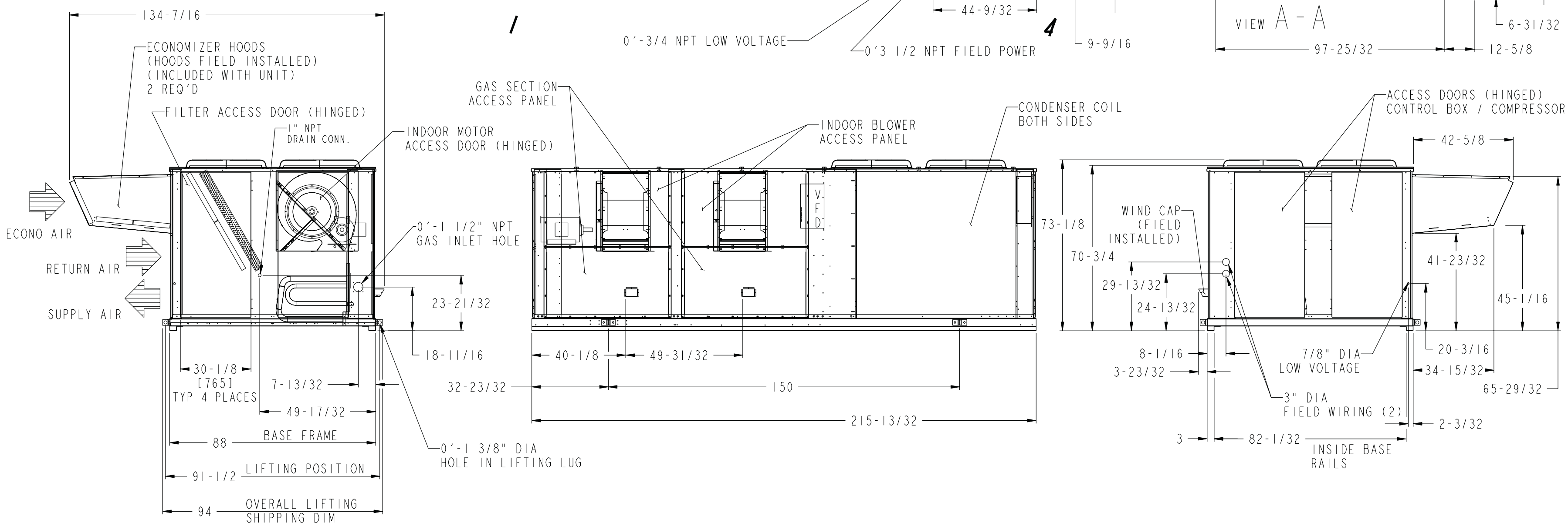


Fig. 15 — Base Unit Dimensions — 48EW,EY038-048

NOTES:
1. Weights include economizer (standard).
2. Center of Gravity.
3. Do not locate adjacent units with flue discharge facing economizer inlet.
Min Clearances to be:
Adjacent Units: 15′-0″ [4572].
Top of Units: No Overhang.
Condenser Coil: 4′-0″ [1219].
Economizer Side: 6′-0″ [1829].
Heat Side: 4′-0″ [1219].
Filter Access Side: 15′-0″ [4572]. (For removal of evaporator coil.)
4. For smaller service and operational clearances contact Carrier Application Engineering Department.
5. Base unit weights include outdoor air hoods and filters (indoor fan motor is not included). Add indoor motor, FIOPs and accessories for total operating weight.
6. VAV motor weights include indoor motor, VFD, compressor electric unloaders, VFD transducer and associated wiring.
7. For side-supply/return applications, a single return and supply ductwork connection is recommended for covering all three return and all three supply openings. The entire area around the duct openings is available for a 1.5″ duct flange attachment
8. Dimensions in are in inches [mm].

BASE UNIT WEIGHTS (See Note 6) lbs (kg)	054	058	064	068
48EWD/EYD	6845 (3105)	7095 (3218)	7345 (3332)	7520 (3411)
48EWE	7085 (3214)	7335 (3327)	7585 (3441)	7760 (3520)

UNIT SIZE	CENTER OF GRAVITY				% OF TOTAL WEIGHT AT EACH CORNER			
	Inches		Millimeters					
	A	B	A	B	1	2	3	4
48EWD/EYD054	130.9	46.9	3325	1192	22.4	19.6	27.0	30.9
48EWE054	133.8	47.4	3397	1204	23.1	19.8	26.3	30.7
48EWD/EYD058	132.1	47.5	3354	1207	22.9	19.5	26.5	31.1
48EWE058	139.5	49.6	3544	1260	25.3	19.6	24.1	31.1
48EWD/EYD064	125.3	45.2	3181	1149	20.7	19.6	29.1	30.7
48EWE064	132.2	47.2	3359	1199	22.8	19.7	26.7	30.8
48EWD/EYD068	127.7	46.6	3242	1184	21.7	19.3	27.7	31.2
48EWE068	134.7	48.6	3422	1235	23.9	19.4	25.4	31.3

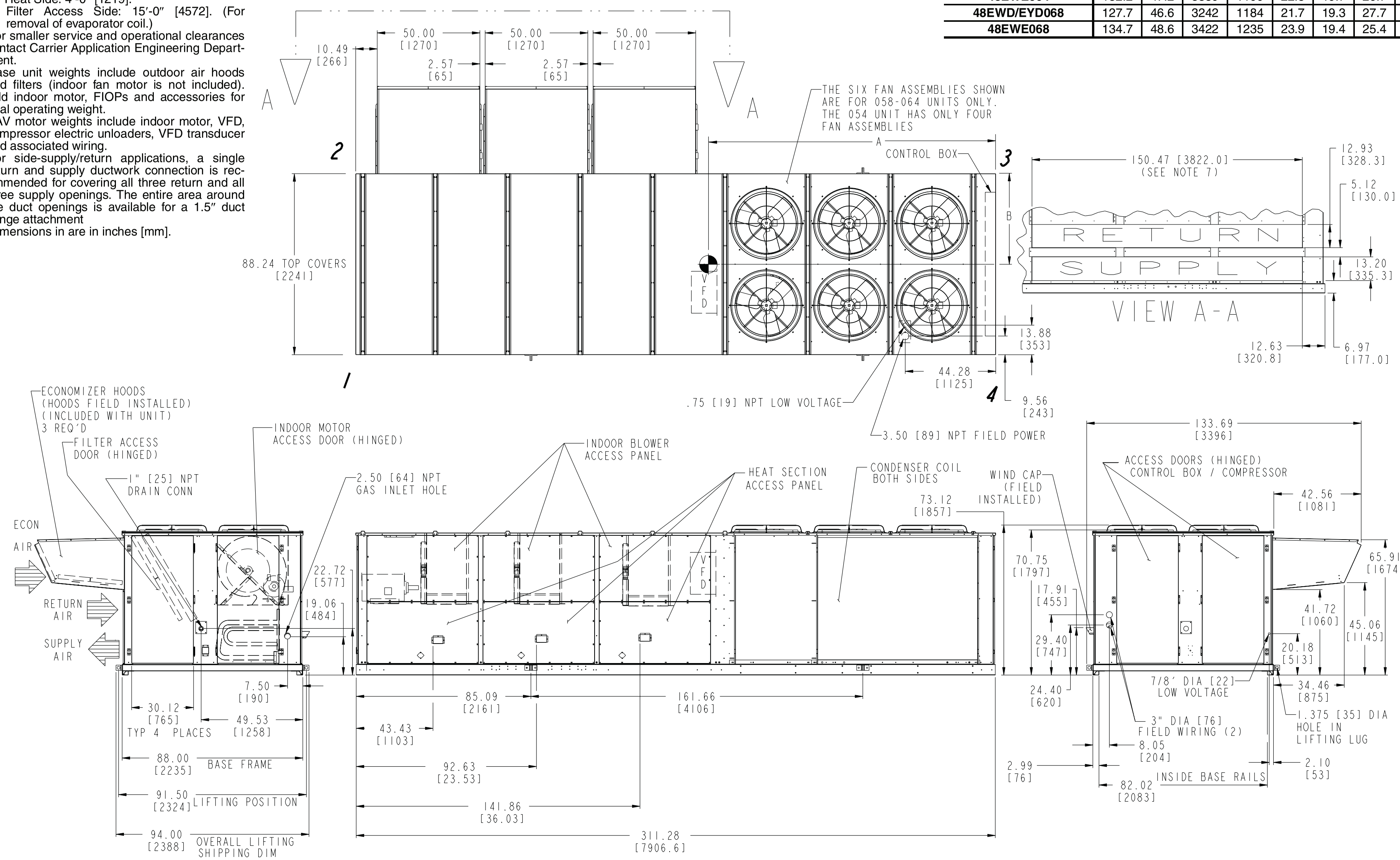
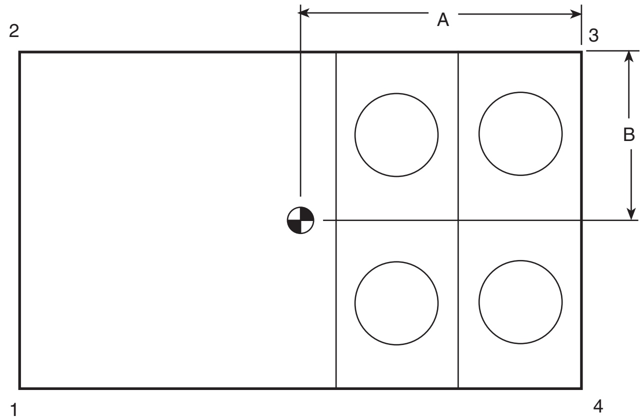


Fig. 16 — Base Unit Dimensions — 48EW,EY054-068



48AJ,AK,AW,AY UNITS

UNIT	CENTER OF GRAVITY				PERCENT OF TOTAL WEIGHT AT EACH CORNER (%)			
	Inches		Millimeters					
	A	B	A	B	1	2	3	4
48AJ,AKD020	72.4	42.2	1839	1072	21.0%	22.8%	29.2%	26.9%
48AJE020	73.3	42.7	1862	1085	21.6%	22.9%	28.6%	27.0%
48AW,AYD020	72.4	42.2	1839	1072	21.0%	22.8%	29.2%	26.9%
48AWE020	73.3	42.7	1862	1085	21.6%	22.9%	28.6%	27.0%
48AJ,AKD025	69.6	44.0	1768	1118	21.1%	21.1%	28.9%	28.9%
48AJE025	70.1	44.3	1781	1125	21.4%	21.1%	28.6%	29.0%
48AW,AYD025	69.6	44.0	1768	1118	21.1%	21.1%	28.9%	28.9%
48AWE025	70.1	44.3	1781	1125	21.4%	21.1%	28.6%	29.0%
48AJ,AKD027	69.6	44.0	1768	1118	21.1%	21.1%	28.9%	28.9%
48AJE027	70.1	44.3	1781	1125	21.4%	21.1%	28.6%	29.0%
48AW,AYD027	69.6	44.0	1768	1118	21.1%	21.1%	28.9%	28.9%
48AWE027	70.1	44.3	1781	1125	21.4%	21.1%	28.6%	29.0%
48AJ,AKD030	69.6	44.0	1768	1118	21.1%	21.1%	28.9%	28.9%
48AJE030	70.1	44.3	1781	1125	21.4%	21.1%	28.6%	29.0%
48AW,AYD030	69.6	44.0	1768	1118	21.1%	21.1%	28.9%	28.9%
48AWE030	70.1	44.3	1781	1125	21.4%	21.1%	28.6%	29.0%
48AJ,AKD035	92.7	46.9	2355	1191	23.0%	20.1%	26.6%	30.3%
48AJE035	94.1	47.2	2390	1199	23.5%	20.3%	26.1%	30.2%
48AW,AYD035	92.7	46.9	2355	1191	23.0%	20.1%	26.6%	30.3%
48AWE035	94.1	47.2	2390	1199	23.5%	20.3%	26.1%	30.2%
48AJ,AKD040	89.3	46.9	2268	1191	22.1%	19.4%	27.3%	31.2%
48AJE040	90.8	47.2	2306	1199	22.7%	19.6%	26.8%	31.0%
48AW,AYD040	89.3	46.9	2268	1191	22.1%	19.4%	27.3%	31.2%
48AWE040	90.8	47.2	2306	1199	22.7%	19.6%	26.8%	31.0%
48AJ,AKD050	87.7	46.5	2228	1181	21.6%	19.2%	27.9%	31.3%
48AJE050	89.2	46.8	2266	1189	22.1%	19.4%	27.4%	31.1%
48AW,AYD050	87.7	46.5	2228	1181	21.6%	19.2%	27.9%	31.3%
48AWE050	89.2	46.8	2266	1189	22.1%	19.4%	27.4%	31.1%
48AJ,AKD060	125.3	45.2	3181	1149	21.7%	19.3%	27.7%	31.2%
48AJE060	132.2	47.2	3359	1199	23.9%	19.4%	25.4%	31.3%
48AW,AYD060	127.7	46.6	3242	1184	21.7%	19.3%	27.7%	31.2%
48AWE060	134.7	48.6	3422	1235	23.9%	19.4%	25.4%	31.3%

Fig. 17 — Rigging Information

48EJ,EK,EW,EY UNITS

UNIT	CENTER OF GRAVITY				PERCENT OF TOTAL WEIGHT AT EACH CORNER (%)			
	Inches		Millimeters					
	A	B	A	B	1	2	3	4
48EJ,EW,EK,EYD024	72.4	42.2	1839	1072	21.0	22.8	29.2	26.9
48EJ,EWE024	73.3	42.7	1862	1085	21.6	22.9	28.6	27.0
48EJ,EW,EK,EYD028	69.6	44.0	1768	1118	21.1	21.1	28.9	28.9
48EJ,EWE028	70.1	44.3	1781	1125	21.4	21.1	28.6	29.0
48EJ,EW,EK,EYD030	69.6	44.0	1768	1118	21.1	21.1	28.9	28.9
48EJ,EWE030	70.1	44.3	1781	1125	21.4	21.1	28.6	29.0
48EJ,EW,EK,EYD034	69.6	44.0	1768	1118	21.1	21.1	28.9	28.9
48EJ,EWE034	70.1	44.3	1781	1125	21.4	21.1	28.6	29.0
48EJ,EW,EK,EYD038	92.7	46.9	2355	1191	23.0	20.1	26.6	30.3
48EJ,EWE038	94.1	47.2	2390	1199	23.5	20.3	26.1	30.2
48EJ,EW,EK,EYD044	89.3	46.9	2268	1191	22.1	19.4	27.3	31.2
48EJ,EWE044	90.8	47.2	2306	1199	22.7	19.6	26.8	31.0
48EJ,EW,EK,EYD048	87.7	46.5	2228	1181	21.6	19.2	27.9	31.3
48EJ,EWE048	89.2	46.8	2226	1189	22.1	19.4	27.4	31.1
48EJ,EW,EK,EYD054	130.9	46.9	3325	1192	22.4	19.6	27.0	30.9
48EJ,EWE054	133.8	47.4	3397	1204	23.1	19.8	26.3	30.7
48EJ,EW,EK,EYD058	132.1	47.5	3354	1207	22.9	19.5	26.5	31.1
48EJ,EWE058	139.5	49.6	3544	1260	25.3	19.6	24.1	31.1
48EJ,EW,EK,EYD064	125.3	45.2	3181	1149	20.7	19.6	29.1	30.7
48EJ,EWE064	132.2	47.2	3359	1199	22.8	19.7	26.7	30.8
48EJ,EW,EK,EYD068	127.7	46.6	3242	1184	21.7	19.3	27.7	31.2
48EJ,EWE068	134.7	48.6	3422	1235	23.9	19.4	25.4	31.3

RIGGING WEIGHTS

48AJ,AK,AW,AY UNITS

UNIT	MAXIMUM UNIT WEIGHTS (lb)*							
	020	025	027	030	035	040	050	060
48AJ,AKD	5142	5228	5325	5325	6004	6514	6725	8930
48AJ,AKE	5222	5308	5405	5405	6164	6674	6885	9170
48AW,AYD	5182	5268	5365	5365	6044	6554	6765	8970
48AW,AYE	5262	5348	5445	5445	6204	6714	6925	9210

*Includes outdoor-air hoods, filters, largest available indoor-fan motor, modulating power exhaust, and the largest available variable frequency drive (VFD).

NOTES:

1. Center of gravity.
2. On 020-050 includes 500 lbs and on 060 725 lbs for modulating power exhaust.
3. On 020-050 includes 170 lbs and on 060 55 lbs for economizer hoods. Includes 45 lbs for the economizer hood packaging.
4. Add 220 lbs for copper coil on the 020-030 size.
5. Add 284 lbs for copper coil on the 035 size.
6. Add 380 lbs for copper coil on the 040-050 size.
7. Add 651 lbs for copper coil on the 060 size.

48EJ,EK,EW,EY UNITS

UNIT	MAXIMUM UNIT WEIGHTS (lb)*										
	024	028	030	034	038	044	048	054	058	064	068
48EJ,EKD	5142	5228	5304	5304	5943	6237	6622	8029	8377	8755	8930
48EJE	5222	5384	5384	5384	6103	6397	6782	8269	8617	8995	9170
48EW,EYD	5182	5404	5344	5344	5983	6277	6662	8069	8417	8795	8970
48EWE	5262	5492	5424	5424	6143	6437	6822	8309	8657	9035	9210

*Includes outdoor-air hoods, filters, largest available indoor-fan motor, modulating power exhaust, and the largest available variable frequency drive (VFD).

NOTES:

1. Center of gravity.
2. Sizes 024-048 includes 500 lb and sizes 054-068 includes 725 lb for modulating power exhaust.
3. Sizes 024-048 includes 170 lb and sizes 054-068 includes 255 lb for economizer hoods.
4. Economizer hood packaging includes 45 lb.
5. For sizes 024-034 add 220 lb for copper coil.
6. For sizes 038-044 add 284 lb for copper coil.
7. For 048 size add 380 lb for copper coil.
8. For 054 size add 271 lb for copper coil.
9. For 058 size add 407 lb for copper coil.
10. For 064 size add 489 lb for copper coil.
11. For 068 size add 651 lb for copper coil.

Fig. 17 — Rigging Information (cont)

Table 1A — Physical Data — 48AJ,AK,AW,AY Units

UNIT 48AJ,AK,AW,AY	020D/E			025D/E			027D/E			030D/E		
NOMINAL CAPACITY (tons)	20			25			27			30		
BASE UNIT OPERATING WEIGHT (lb)	See Operating Weights Table 2.											
COMPRESSOR												
Quantity...Type (Ckt 1 , Ckt 2)	1...06D328, 1...06D818			2...06D328			2...06D328			1...06D537, 1…06D328		
Number of Refrigerant Circuits	2			2			2			2		
Oil (oz) (Ckt 1 , Ckt 2)	115, 88			115 ea.			115 ea.			115 ea.		
REFRIGERANT TYPE	R-22											
Operating Charge (lb-oz)												
Circuit 1	25-0			25-0			29-0			27-0		
Circuit 2	31-0			25-0			28-0			29-0		
CONDENSER COIL *	Cross-Hatched $^3/_8$" Copper Tubes, Aluminum Lanced, Aluminum Pre-Coated, or Copper Plate Fins											
Quantity	1			1			1			1		
Rows...Fins/in.	4...15			4...15			4...15			4...15		
Total Face Area (sq ft)	33.3			33.3			33.3			33.3		
CONDENSER FAN	Propeller Type											
Nominal Cfm	13,420			13,420			13,420			13,420		
Quantity...Diameter (in.)	2...30			2...30			2...30			2...30		
Motor Hp	1			1			1			1		
EVAPORATOR COIL	Cross-Hatched Copper Tubes, Aluminum Plate Fins											
Tube Size (in.)	$^3/_8$			$^3/_8$			$^3/_8$			$^3/_8$		
Rows...Fins/in.	4...15			4...15			4...15			4... 5		
Total Face Area (sq ft)	31.7			31.7			34.7			34.7		
EVAPORATOR FAN	Centrifugal Type											
Quantity...Size (in.)	2...20 X 15			2... 20 X 15			2... 20 X 15			2... 20 X 15		
Type Drive	Belt			Belt			Belt			Belt		
Nominal Cfm	8,000			10,000			11,000			12,000		
Motor Hp	5	10	15	7.5	10	15	10	15	20	10	15	20
Motor Frame Size	184T	215T	254T	213T	215T	254T	215T	254T	256T	215T	254T	256T
Motor Bearing Type	Ball			Ball			Ball			Ball		
Maximum Allowable Rpm	1200			1200			1200			1200		
Motor Pulley Pitch Diameter	4.9	4.4	5.7	5.4	6.1	5.5	4.4	4.9	5.9	4.4	5.7	5.9
Nominal Motor Shaft Diameter (in.)	$1^1/_8$	$1^3/_8$	$1^3/_8$	$1^3/_8$	$1^3/_8$	$1^5/_8$	$1^3/_8$	$1^5/_8$	$1^5/_8$	$1^3/_8$	$1^5/_8$	$1^5/_8$
Fan Pulley Pitch Diameter (in.)	12.4	8.6	9.1	12.4	11.1	8.7	9.4	8.1	8.7	9.0	9.1	8.7
Nominal Fan Shaft Diameter (in.)	$1^{15}/_{16}$			$1^{15}/_{16}$			$1^{15}/_{16}$			$1^{15}/_{16}$		
Belt Quantity	1	2	2	1	1	2	2	2	2	2	2	2
Belt Type	BX56	BX50	5VX530	BX56	5VX590	5VX570	BX50	5VX500	5VX530	BX50	5VX530	5VX530
Belt Length (in.)	56	63	53	56	59	57	50	50	53	50	53	53
Pulley Center Line Distance (in.)	16.0-18.7	15.6-18.4	15.0-17.9	15.6-18.4	15.6-18.4	15.0-17.9	15.6-18.4	15.0-17.9	15.0-17.9	15.6-18.4	15.0-17.9	15.0-17.9
Factory Speed Setting (rpm)	717	924	1096	773	962	1106	848	1059	1187	884	1096	1187
FURNACE SECTION												
Rollout Switch Cutout Temp (F) †	225			225			225			225		
Burner Orifice Diameter (in. ...drill size)												
Natural Gas Std	.111...34			.111...34			.111...34			.111...34		
Liquid Propane Alt	.089...43			.089...43			.089...43			.089...43		
Thermostat Heat Anticipator Setting												
Stage 1 (amps)	0.1			0.1			0.1			0.1		
Stage 2 (amps)	0.1			0.1			0.1			0.1		
Gas Input (Btuh) Stage 1	262,500/394,000			262,500/394,000			262,500/394,000			262,500/394,000		
Stage 2	350,000/525,000			350,000/525,000			350,000/525,000			350,000/525,000		
Efficiency (Steady State) (%)	82			82			82			82		
Temperature Rise Range	15-45/35-65			15-45/35-65			15-45/35-65			15-45/35-65		
Manifold Pressure (in. wg)												
Natural Gas Std	3.5			3.5			3.5			3.5		
Liquid Propane Alt	3.5			3.5			3.5			3.5		
Gas Valve Quantity	2			2			2			2		
HIGH-PRESSURE SWITCH (psig)												
Cutout	426			426			426			426		
Reset (Auto.)	320			320			320			320		
LOW-PRESSURE SWITCH (psig)												
Cutout	27			27			27			27		
Reset (Auto.)	67			67			67			67		
RETURN-AIR FILTERS												
Quantity...Size (in.)	10...20 x 24 x 2			10...20 x 24 x 2			10...20 x 24 x 2			10...20 x 24 x 2		
OUTDOOR AIR FILTERS												
Quantity...Size (in.)	8...16 x 25 4...20 x 25			8...16 x 25 4...20 x 25			8...16 x 25 4..20 x 25			8...16 x 25 4...20 x 25		

LEGEND

Al — Aluminum
Bhp — Brake Horsepower
Cu — Copper

*Sizes 020-030: Circuit 1 uses the lower portion of condenser coil, Circuit 2 uses the upper portion.
Sizes 035-050: Circuit 1 uses the left condenser coil, Circuit 2 the right. All units have intertwined evaporator coils.
†Rollout switch is manual reset.

NOTE: High heat is for 48AJ,AW only.

Table 1A — Physical Data — 48AJ,AK,AW,AY Units (cont)

UNIT 48AJ,AK,AW,AY		035D/E			040D/E			050D/E			060D/E	
NOMINAL CAPACITY (tons)		35			40			50			60	
BASE UNIT OPERATING WEIGHT (lb)	See Operating Weights Table 2.											
COMPRESSOR												
Quantity...Type (Ckt 1 , Ckt 2)		2...06D537			1...06D537, 1...06EA250			2…06EA250			2...06EA265	
Number of Refrigerant Circuits		2			2			2			2	
Oil (oz) (Ckt 1 , Ckt 2)		115 ea.			115, 224			224 ea.			304 ea.	
REFRIGERANT TYPE												
Operating Charge (lb-oz)												
Circuit 1		34-8			51-8			50-0			79-8	
Circuit 2		34-8			49-8			50-0			79-8	
CONDENSER COIL *	Cross-Hatched $\frac{3}{8}$" Copper Tubes, Aluminum Lanced, Aluminum Pre-Coated, or Copper Plate Fins											
Quantity		2			2			2			2	
Rows...Fins/in.		3…15			4…15			4…15			4…15	
Total Face Area (sq ft)		58.3			66.7			66.7			100	
CONDENSER FAN	Propeller Type											
Nominal Cfm		27,064			27,064			27,064			43,900	
Quantity...Diameter (in.)		4...30			4...30			4...30			6...30	
Motor Hp		1			1			1			1	
EVAPORATOR COIL	Cross-Hatched Copper Tubes, Aluminum Plate Fins											
Tube Size (in.)		$\frac{3}{8}$			$\frac{1}{2}$			$\frac{1}{2}$			$\frac{1}{2}$	
Rows...Fins/in.		4…15			6…15			6…15			4…17	
Total Face Area (sq ft)		34.7			31.3			31.3			48.1	
EVAPORATOR FAN	Centrifugal Type											
Quantity...Size (in.)		2...20 X 15			2...20 X 15			2...20 X 15			3...20 X 15	
Type Drive		Belt			Belt			Belt			Belt	
Nominal Cfm		14,000			16,000			20,000			24,000	
Motor Hp	10	15	20	15	20	25	20	25	30	25	30	40
Motor Frame Size	215T	254T	256T	254T	256T	284T	256T	284T	286T	284T	286T	324T
Motor Bearing Type		Ball			Ball			Ball			Ball	
Maximum Allowable Rpm		1200			1200			1300			1200	
Motor Pulley Pitch Diameter	6.1	5.3	5.7	5.3	5.7	7.5	6.3	8.1	7.5	5.3	8.1	9.4
Nominal Motor Shaft Diameter (in.)	$1\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{5}{8}$	$1\frac{5}{8}$	$1\frac{5}{8}$	$1\frac{7}{8}$	$1\frac{5}{8}$	$1\frac{7}{8}$	$1\frac{7}{8}$	$1\frac{7}{8}$	$1\frac{7}{8}$	$2\frac{1}{8}$
Fan Pulley Pitch Diameter (in.)	13.7	9.5	9.5	9.5	9.5	11.1	11.1	12.5	11.1	9.1	12.5	13.6
Nominal Fan Shaft Diameter (in.)		$1\frac{15}{16}$			$1\frac{15}{16}$			$1\frac{15}{16}$			$1\frac{15}{16}$	
Belt Quantity	1	2	2	2	2	2	2	2	2	3	3	2
Belt Type	5VX610	5VX530	5VX550	5VX530	5VX550	5VX590	5VX570	5VX630	5VX590	5VX530	5VX630	5VX650
Belt Length (in.)	61	53	55	53	55	59	57	63	59	53	63	65
Pulley Center Line Distance (in.)	15.6-18.4	15.0-17.9	15.0-17.9	15.0-17.9	15.0-17.9	14.6-17.6	15.0-17.9	14.6-17.6	14.6-17.6	15.2-17.5	14.7-17.2	14.2-17.0
Factory Speed Setting (rpm)	779	976	1050	976	1050	1182	993	1134	1182	1019	1134	1214
FURNACE SECTION												
Rollout Switch Cutout												
Temp (F) †		225			225			225			225	
Burner Orifice Diameter (in. ...drill size)												
Natural Gas Std		.120...31			.120...31			.120...31			.120...31	
Liquid Propane Alt		.096...41			.096...41			.096...41			.096...41	
Thermostat Heat Anticipator Setting												
Stage 1 (amps)		0.1			0.1			0.1			0.1	
Stage 2 (amps)		0.1			0.1			0.1			0.1	
Gas Input (Btuh) Stage 1		300,000/600,000			300,000/600,000			300,000/600,000			582,000/ 873,000	
Stage 2		400,000/800,000			400,000/800,000			400,000/800,000			776,000/1,164,000	
Efficiency (Steady State) (%)		82			82			82			82	
Temperature Rise Range		10-40/30-60			10-40/30-60			10-40/30-60			10-40/30-60	
Manifold Pressure (in. wg)												
Natural Gas Std		3.5			3.5			3.5			3.3	
Liquid Propane Alt		3.5			3.5			3.5			3.3	
Gas Valve Quantity		2			2			2			3	
HIGH-PRESSURE SWITCH (psig)												
Cutout		426			426			426			426	
Reset (Auto.)		320			320			320			320	
LOW-PRESSURE SWITCH (psig)												
Cutout		27			27			27			27	
Reset (Auto.)		67			67			67			67	
RETURN-AIR FILTERS												
Quantity...Size (in.)		10...20 x 24 x 2			10...20 x 24 x 2			10...20 x 24 x 2			16...20 x 24 x 2	
OUTDOOR AIR FILTERS												
Quantity...Size (in.)		8...16 x 25 4...20 x 25			8...16 x 25 4...20 x 25			8...16 x 25 4...20 x 25			12...16 x 25 6...20 x 25	

LEGEND

Al — Aluminum
Bhp — Brake Horsepower
Cu — Copper

*Sizes 020-030: Circuit 1 uses the lower portion of condenser coil, Circuit 2 uses the upper portion.
Sizes 035-050: Circuit 1 uses the left condenser coil, Circuit 2 the right. All units have intertwined evaporator coils.
†Rollout switch is manual reset.

NOTE: High heat is for 48AJ,AW only.

Table 1B — Physical Data — 48EJ,EK,EW,EY Units

UNIT 48EJ,EK,EW,EY	024D/E	028D/E	030D/E	034D/E
NOMINAL CAPACITY (tons)	20	25	27.5	30
OPERATING WEIGHT (lb)	For Operating Weights see Table 2.			
COMPRESSOR				
Type Ckt 1	06D328	06D328	06D537	06D537
Ckt 2	06D818	06D328	06D328	06D537
Number of Refrigerant Circuits	2	2	2	2
Oil (oz) (Ckt 1, Ckt 2)	115, 88	115 ea.	115 ea.	115 ea.
REFRIGERANT TYPE	R-22			
Operating Charge (lb-oz)				
Circuit 1*	25-0	25-0	25-0	25-0
Circuit 2	31-0	25-0	25-0	25-0
CONDENSER COIL	Cross-Hatched $^3/_8$″ Copper Tubes, Aluminum Lanced, Aluminum Pre-Coated, or Copper Plate Fins			
Quantity	1	1	1	1
Rows...Fins/in.	4...15	4...15	4...15	4...15
Total Face Area (sq ft)	33.3	33.3	33.3	33.3
CONDENSER FAN	Propeller Type			
Nominal Cfm	13,420	13,420	13,420	13,420
Quantity...Diameter (in.)	2...30	2...30	2...30	2...30
Motor Hp (1075 Rpm)	1	1	1	1
EVAPORATOR COIL	Cross-Hatched $^3/_8$″ Copper Tubes, Aluminum Plate Fins, Intertwined Circuits			
Rows...Fins/in.	4...15	4...15	4...15	4...15
Total Face Area (sq ft)	31.7	31.7	31.7	31.7

UNIT 48EJ,EK,EW,EY	024D/E			028D/E			030D/E			034D/E		
EVAPORATOR FAN	Centrifugal Type											
Quantity...Size (in.)	2...20x15			2...20x15			2...20x15			2...20x15		
Type Drive	Belt			Belt			Belt			Belt		
Nominal Cfm	8,000			10,000			11,000			12,000		
Motor Hp	5	10†	15	7.5	10†	15	10	15†	20	10	15†	20
Motor Frame Size (Standard)	S184T	S215T	D254T	S213T	S215T	D254T	S215T	D254T	S256T	S215T	D254T	S256T
(High Efficiency)	S184T	S215T	S254T	S213T	S215T	S254T	S215T	S254T	S256T	S215T	S254T	S256T
Motor Bearing Type	Ball			Ball			Ball			Ball		
Maximum Allowable Rpm	1200			1200			1200			1200		
Motor Pulley Pitch Diameter	4.9	4.4	5.7	5.4	6.1	5.5	4.4	4.9	5.9	4.4	5.7	5.9
Nominal Motor Shaft Diameter (in.)	$1^1/_8$	$1^3/_8$	$1^5/_8$	$1^3/_8$	$1^3/_8$	$1^5/_8$	$1^3/_8$	$1^5/_8$	$1^5/_8$	$1^3/_8$	$1^5/_8$	$1^5/_8$
Fan Pulley Pitch Diameter (in.)	12.4	8.6	9.1	12.4	11.1	8.7	9.4	8.1	8.7	9.0	9.1	8.7
Nominal Fan Shaft Diameter (in.)	$1^{15}/_{16}$			$1^{15}/_{16}$			$1^{15}/_{16}$			$1^{15}/_{16}$		
Belt, Quantity...Type	1...BX56	2...BX50	2...5VX530	1...BX56	1...5VX570	2...5VX530	2...BX50	2...5VX500	2...5VX530	2...BX50	2...5VX530	2...5VX530
Belt, Length (in.)	56	50	53	56	59	57	50	50	53	50	53	53
Pulley Center Line Distance (in.)	16.0-18.7	15.6-18.4	15.0-17.9	15.6-18.4		15.0-17.9	15.6-18.4	15.0-17.9		15.6-18.4	15.0-17.9	
Factory Speed Setting (rpm)	717	924	1096	773	962	1106	848	1059	1187	884	1096	1187

UNIT 48EJ,EK,EW,EY	024D/E	028D/E	030D/E	034D/E
FURNACE SECTION				
Rollout Switch Cutout Temp (F)**	225	225	225	225
Burner Orifice Diameter (in. ...drill size)				
Natural Gas Std	.111...34	.111...34	.111...34	.111...34
Liquid Propane Alt	.089...43	.089...43	.089...43	.089...43
Thermostat Heat Anticipator Setting (amps)				
Stage 1	0.1	0.1	0.1	0.1
Stage 2	0.1	0.1	0.1	0.1
Gas Input (Btuh) Stage 1 Low	265,600	265,600	265,600	265,600
High	398,400	398,400	398,400	398,400
Stage 2 Low	350,000	350,000	350,000	350,000
High	525,000	525,000	525,000	525,000
Efficiency (Steady State) (%)	82	82	82	82
Temperature Rise Range	15-45/35-65	15-45/35-65	15-45/35-65	15-45/35-65
Gas Pressure to Unit Range (in. wg)	5-13.5	5-13.5	5-13.5	5-13.5
Manifold Pressure (in. wg)				
Natural Gas Std	3.5	3.5	3.5	3.5
Liquid Propane Alt	3.5	3.5	3.5	3.5
Gas Valve Quantity	2	2	2	2
Field Gas Connection Size (in.-FPT)	1.5	1.5	1.5	1.5
HIGH-PRESSURE SWITCH (psig)				
Cutout	426	426	426	426
Reset (Auto.)	320	320	320	320
LOW-PRESSURE SWITCH (psig)				
Cutout	7	7	7	7
Reset (Auto.)	22	22	22	22
RETURN-AIR FILTERS (W x H x T) Quantity...Size (in.)	10...20 x 24 x 2	10...20 x 24 x 2	10...20 x 24 x 2	10...20 x 24 x 2
OUTDOOR-AIR FILTERS Quantity...Size (in.)	8...16 x 25 4...20 x 25	8...16 x 25 4...20 x 25	8...16 x 25 4...20 x 25	8...16 x 25 4...20 x 25
POWER EXHAUST	Direct Drive, 3-Speed, Single-Phase Motor (Factory-Wired for High Speed) and Forward Curved Fan			
Motor, Quantity...Hp	4...1			
Fan, Diameter...Width (in.)	11...10			

*Sizes 024-034: Circuit 1 uses the lower portion of condenser coil, Circuit 2 uses the upper portion.
Sizes 038-048: Circuit 1 uses the left condenser coil, Circuit 2 the right. All units have intertwined evaporator coils.
†Motor and drive shown will deliver approximately 2.5 in. wg net external static. For more information, see Table 3.
**Rollout switch is manual reset.

NOTE: High heat is for 48EJ,EW only.

Table 1B — Physical Data — 48EJ,EK,EW,EY Units (cont)

UNIT 48EJ,EK,EW,EY	034D/E			044D/E			048D/E		
NOMINAL CAPACITY (tons)	35			40			45		
OPERATING WEIGHT (lb)	For Operating Weights see Table 2.								
COMPRESSOR									
Type Ckt 1	06D537			06EA250			06EA265		
Ckt 2	06D537			06EA250			06EA250		
Number of Refrigerant Circuits	2			2			2		
Oil (oz) (Ckt 1, Ckt 2)	115 ea.			224 ea.			304, 224		
REFRIGERANT TYPE	R-22								
Operating Charge (lb-oz)									
Circuit 1*	34-0			35-0			41-0		
Circuit 2	34-0			35-0			41-0		
CONDENSER COIL	Cross-Hatched $^3/_8$″ Copper Tubes, Aluminum Lanced, Aluminum Pre-Coated, or Copper Plate Fins								
Quantity	2			2			1	1	
Rows...Fins/in.	4...15			4...15			4...15	3...15	
Total Face Area (sq ft)	58.3			58.3			66.7		
CONDENSER FAN	Propeller Type								
Nominal Cfm	27,064			27,064			27,064		
Quantity...Diameter (in.)	4...30			4...30			4...30		
Motor Hp (1075 Rpm)	1			1			1		
EVAPORATOR COIL	Cross-Hatched $^3/_8$″ Copper Tubes, Aluminum Plate Fins, Intertwined Circuits								
Rows...Fins/in.	3...15			3...15			4...15		
Total Face Area (sq ft)	34.7			34.7			34.7		
EVAPORATOR FAN	Centrifugal Type								
Quantity...Size (in.)	2...20x15			2...20x15			2...20x15		
Type Drive	Belt			Belt			Belt		
Nominal Cfm	14,000			16,000			18,000		
Motor Hp	10	15†	20	15	20†	25	20	25†	30
Motor Frame Size (Standard)	S215T	D254T	S256T	D254T	S256T	S284T	S256T	S284T	S286T
(High Efficiency)	S215T	S254T	S256T	S254T	S256T	S284T	S256T	S284T	S286T
Motor Bearing Type	Ball			Ball			Ball		
Maximum Allowable Rpm	1200			1200			1200		
Motor Pulley Pitch Diameter	6.1	5.3	5.7	5.3	5.7	7.5	6.3	8.1	7.5
Nominal Motor Shaft Diameter (in.)	1 $^3/_8$	1 $^5/_8$	1 $^5/_8$	1 $^5/_8$	1 $^5/_8$	1 $^7/_8$	1 $^5/_8$	1 $^7/_8$	1 $^7/_8$
Fan Pulley Pitch Diameter (in.)	13.7	9.5	9.5	9.5	9.5	11.1	11.1	12.5	11.1
Nominal Fan Shaft Diameter (in.)	1 $^{15}/_{16}$			1 $^{15}/_{16}$			1 $^{15}/_{16}$		
Belt, Quantity...Type	1...5VX610	2...5VX530	2...5VX550	2...5VX530	2...5VX550	2...5VX590	2...5VX570	2...5VX630	2...5VX590
Belt, Length (in.)	61	53	55	53	55	59	57	63	59
Pulley Center Line Distance (in.)	15.6-18.4	15.0-17.9		15.0-17.9		14.6-17.6	15.0-17.9	14.6-17.6	
Factory Speed Setting (rpm)	779	976	1050	976	1050	1182	993	1134	1182
FURNACE SECTION									
Rollout Switch Cutout Temp (F)**	225			225			225		
Burner Orifice Diameter (in. ...drill size)									
Natural Gas Std	.120...31			.120...31			.120...31		
Liquid Propane Alt	.096...41			.096...41			.096...41		
Thermostat Heat Anticipator Setting (amps)									
Stage 1	0.1			0.1			0.1		
Stage 2	0.1			0.1			0.1		
Gas Input (Btuh) Stage 1 Low	303,500			303,500			303,500		
High	607,000			607,000			607,000		
Stage 2 Low	400,000			400,000			400,000		
High	800,000			800,000			800,000		
Efficiency (Steady State) (%)	82			82			82		
Temperature Rise Range	10-40/30-60			10-40/30-60			10-40/30-60		
Gas Pressure to Unit Range (in. wg)	5-13.5			5-13.5			5-13.5		
Manifold Pressure (in. wg)									
Natural Gas Std	3.5			3.5			3.5		
Liquid Propane Alt	3.5			3.5			3.5		
Gas Valve Quantity	2			2			2		
Field Gas Connection Size (in.-FPT)	1.5			1.5			1.5		
HIGH-PRESSURE SWITCH (psig)									
Cutout	426			426			426		
Reset (Auto.)	320			320			320		
LOW-PRESSURE SWITCH (psig)									
Cutout	7			7			7		
Reset (Auto.)	22			22			22		
RETURN-AIR FILTERS (W x H x T)									
Quantity...Size (in.)	10...20 x 24 x 2			10...20 x 24 x 2			10...20 x 24 x 2		
OUTDOOR-AIR FILTERS Quantity...Size (in.)	8...16 x 25 4...20 x 25			8...16 x 25 4...20 x 25			8...16 x 25 4...20 x 25		
POWER EXHAUST	Direct Drive, 3-Speed, Single-Phase Motor (Factory-Wired for High Speed) and Forward Curved Fan								
Motor, Quantity...Hp	4...1								
Fan, Diameter...Width (in.)	11...10								

*Sizes 024-034: Circuit 1 uses the lower portion of condenser coil, Circuit 2 uses the upper portion.
Sizes 038-048: Circuit 1 uses the left condenser coil, Circuit 2 the right. All units have intertwined evaporator coils.
†Motor and drive shown will deliver approximately 2.5 in. wg net external static. For more information, see Table 3.
**Rollout switch is manual reset.

NOTE: High heat is for 48EJ,EW only.

Table 1B — Physical Data — 48EJ,EK,EW,EY Units (cont)

UNIT 48EJ,EK,EW,EY	054D/E			058D/E			064D/E			068D/E		
NOMINAL CAPACITY (tons)		50			55			60			65	
OPERATING WEIGHT (lb)	For Operating Weights see Table 2.											
COMPRESSOR												
Quantity...Type (Ckt 1, Ckt 2)		1...06EA265, 1...06EA250			1...06EA275, 1...06EA250			1...06EA275, 1...06EA265			2...06EA275	
Number of Refrigerant Circuits		2			2			2			2	
Oil (oz) (Ckt 1, Ckt 2)		304, 224			304, 224			304, 304			304, 304	
REFRIGERANT TYPE	R-22											
Operating Charge (lb-oz)												
Circuit 1*		50-11			57-0			68-0			81-0	
Circuit 2		46-8			48-6			68-0			73-0	
CONDENSER COIL	Cross-Hatched $^3/_8$″-in. Copper Tubes, Aluminum Lanced, Aluminum Pre-Coated, or Copper Plate Fins											
Quantity	1	1		1	1			2			2	
Rows...Fins/in.	3...15	2...15		3...15	2...15			3...15			4...15	
Total Face Area (sq ft)		66.6			100.0			100			100	
CONDENSER FAN	Propeller Type											
Nominal Cfm		30,000			43,900			43,900			43,900	
Quantity...Diameter (in.)		4...30			6...30			6...30			6...30	
Motor Hp (1075 Rpm)		1			1			1			1	
EVAPORATOR COIL	Cross-Hatched $^1/_2$″-in. Copper Tubes, Aluminum Plate Fins, Intertwined Circuits											
Rows...Fins/in.		4...17			4...17			4...17			4...17	
Total Face Area (sq ft)		45.0			45.0			48.1			48.1	
EVAPORATOR FAN	Centrifugal Type											
Quantity...Size (in.)		3...20x15			3...20x15			3...20x15			3...20x15	
Type Drive		Belt			Belt			Belt			Belt	
Nominal Cfm		20,000			22,000			24,000			26,000	
Motor Hp	15	20†	25	20	25†	30	25	30†	40	25	30†	40
Motor Frame Size	S254T	S256T	S284T	S256T	S284T	S286T	S284T	S286T	S324T	S284T	S286T	S324T
Motor Bearing Type		Ball			Ball			Ball			Ball	
Maximum Allowable Rpm		1200			1200			1200			1200	
Motor Pulley Pitch Diameter	4.7	6.1	8.1	5.9	6.7	7.5	5.3	8.1	9.4	6.7	5.9	9.4
Nominal Motor Shaft Diameter (in.)	$1^5/_8$	$1^5/_8$	$1^7/_8$	$1^5/_8$	$1^7/_8$	$1^7/_8$	$1^7/_8$	$1^7/_8$	$2^1/_8$	$1^7/_8$	$1^7/_8$	$2^1/_8$
Fan Pulley Pitch Diameter (in.)	11.1	11.1	12.5	11.1	11.1	11.1	9.1	12.5	13.6	12.5	9.5	13.6
Nominal Fan Shaft Diameter (in.)		$1^{15}/_{16}$			$1^{15}/_{16}$			$1^{15}/_{16}$			$1^{15}/_{16}$	
Belt, Quantity...Type	2...5VX550	2...5VX570	2...5VX630	2...5VX570	2...5VX590	2...5VX590	3...5VX530	2...5VX630	2...5VX650	2...5VX610	3...5VX550	2...5VX650
Length (in.)	55	57	63	57	59	59	53	63	65	61	55	59
Pulley Center Line Distance (in.)	15.2-17.5	15.2-17.5	14.7-17.2	15.2-17.5	14.7-17.2	14.7-17.2	14.7-17.2	14.7-17.2	14.2-17.0	14.7-17.2	14.7-17.2	14.3-17.0
Factory Speed Setting (rpm)	741	962	1134	930	1056	1182	1019	1134	1214	938	1087	1214
FURNACE SECTION												
Rollout Switch Cutout Temp (F)**		225			225			225			225	
Burner Orifice Diameter (in. ...drill size)												
Natural Gas Std		.120...31			.120...31			.120...31			.120...31	
Liquid Propane Alt		.096...41			.096...41			.096...41			.096...41	
Thermostat Heat Anticipator Setting (amps)												
Stage 1		0.1			0.1			0.1			0.1	
Stage 2		0.1			0.1			0.1			0.1	
Gas Input (Btuh) Stage 1		441,000/ 873,000			441,000/ 873,000			441,000/ 873,000			441,000/ 873,000	
Stage 2		662,400/1,164,000			662,400/1,164,000			662,400/1,164,000			662,400/1,164,000	
Efficiency (Steady State) (%)		82			82			82			82	
Temperature Rise Range		10-40/30-60			10-40/30-60			10-40/30-60			10-40/30-60	
Gas Pressure to Unit Range (in. wg)		5 - 13.5			5 - 13.5			5 - 13.5			5 - 13.5	
Manifold Pressure (in. wg)												
Natural Gas Std		3.3			3.3			3.3			3.3	
Liquid Propane Alt		3.3			3.3			3.3			3.3	
Gas Valve Quantity		3			3			3			3	
Field Gas Connection Size (in.-FPT)		2.5			2.5			2.5			2.5	
HIGH-PRESSURE SWITCH (psig)												
Cutout		426			426			426			426	
Reset (Auto.)		320			320			320			320	
LOW-PRESSURE SWITCH (psig)												
Cutout		7			7			7			7	
Reset (Auto.)		22			22			22			22	
RETURN-AIR FILTERS (W x H x T)												
Quantity...Size (in.)		16...20 x 24 x 2			16...20 x 24 x 2			16...20 x 24 x 2			16...20 x 24 x 2	
OUTDOOR-AIR FILTERS												
Quantity...Size (in.)		12...16 x 25 6...20 x 25			12...16 x 25 6...20 x 25			12...16 x 25 6...20 x 25			12...16 x 25 6...20 x 25	
POWER EXHAUST	Direct Drive, 3-Speed, Single-Phase Motor (Factory-Wired for High Speed) and Forward Curved Fan											
Motor, Quantity...Hp	6...1											
Fan, Diameter...Width (in.)	11...10											

*Circuit 1 uses the left condenser coil. Circuit 2 the right. All units have intertwined evaporator coils.
†Motor and drive shown will deliver approximately 2.5 in. wg net external static pressure. For more information see Table 3.
**Rollout switch is manual reset.

NOTE: High heat is for 48EJ,EW.

Table 2 — Operating Weights

48AJ,AK,AW,AY Units

UNIT	BASE UNIT WEIGHTS (Lb)*							
	020	025	027	030	035	040	050	060
48AJD,AKD	4287	4373	4394	4394	5073	5515	5628	7480
48AJE	4367	4453	4474	4474	5233	5675	5788	7720
48AWD,AYD	4327	4413	4434	4434	5113	5555	5668	7520
48AWE	4407	4493	4514	4514	5273	5715	5828	7760

OPTION/ ACCESSORY	OPTION/ACCESSORY WEIGHTS (Lb)							
	020	025	027	030	035	040	050	060
Barometric Relief	300	300	300	300	300	300	300	450
Power Exhaust	450	450	450	450	450	450	450	675
Modulating Power Exhaust	500	500	500	500	500	500	500	725
Cu Tubing/Cu Fin Condenser Coil	220	220	220	220	285	285	380	651
Roof Curb (14-in. curb)	365	365	365	365	410	410	410	585

48EJ,EK,EW,EY Units

UNIT	BASE UNIT WEIGHTS (Lb)*										
	024	028	030	034	038	044	048	054	058	064	068
48EJ,EKD	4287	4373	4373	4373	5012	5238	5525	6805	7055	7305	7480
48EJE	4367	4453	4453	4453	5172	5398	5685	7045	7295	7545	7720
48EW,EYD	4327	4413	4413	4413	5052	5278	5565	6845	7095	7345	7520
48EWE	4407	4493	4493	4493	5212	5438	5725	7085	7335	7585	7760

OPTION/ ACCESSORY	OPTION/ACCESSORY WEIGHTS (Lb)										
	024	028	030	034	038	044	048	054	058	064	068
Barometric Relief	300	300	300	300	300	300	300	450	450	450	450
Power Exhaust	450	450	450	450	450	450	450	675	675	675	675
Modular Power Exhaust	500	500	500	500	500	500	500	725	725	725	725
Cu Tubing/Cu Fin Condenser Coil	220	220	220	220	285	285	380	271	407	489	651
Roof Curb (14-in. curb)	365	365	365	365	410	410	410	585	585	585	585

CV MOTOR WEIGHTS (Lb)

MOTOR HP	UNIT VOLTAGE	STANDARD EFFICIENCY IFM	HIGH EFFICIENCY IFM
5	230/460	78	94
	575	78	92
7.5	230/460	107	135
	575	107	136
10	230/460	118	164
	575	118	156
15	230/460	150	217
	575	150	220
20	230/460	212	250
	575	212	258
25	230/460	240	309
	575	240	319
30	230/460	283	355
	575	283	359
40	230/460	372	415
	575	372	410

VAV MOTOR WEIGHTS (Lb)

MOTOR HP	UNIT VOLTAGE	STANDARD EFFICIENCY IFM	HIGH EFFICIENCY IFM
5	230/460	125	141
	575	163	177
7.5	230/460	183	211
	575	193	222
10	230/460	204	250
	575	204	242
15	230/460	238	305
	575	240	310
20	230/460	348	386
	575	304	350
25	230/460	377	446
	575	375	454
30	230/460	480	552
	575	418	494
40	230/460	637	680
	575	587	625

LEGEND

Cu — Copper
CV — Constant Volume
FIOP — Factory-Installed Option
HP — Horsepower
IFM — Indoor Fan Motor
VAV — Variable Air Volume
VFD — Variable Frequency Drive

*Outdoor-air hoods and filters included in base unit weights; indoor-fan motors are NOT included.

NOTES:
1. Base unit weight includes outdoor-air hoods. Base unit weight does NOT include indoor-fan motor. ADD indoor-fan motor, FIOPs, and accessories for TOTAL operating weight.
2. The VAV motor weights include indoor fan motor and the VFD (variable frequency drive), compressor electric unloaders, VFD transducers, and associated wiring.

Table 3 — Evaporator Fan Motor Data

UNIT SIZE 48AJ,AK, AW,AY	UNIT SIZE 48EJ,EK, EW,EY	MOTOR HP	MOTOR SHAFT DIA. (in.)	FAN SHAFT SPEED (rpm)	MOTOR SHEAVE	MOTOR SHEAVE PITCH DIAMETER (in.)	BUSHING DIAMETER (in.)	FAN SHEAVE	FAN SHEAVE PITCH DIAMETER (in.)	BUSHING DIAMETER (in.)	BELT (Quantity)	BELT TENSION (lb at .25 in.)
020	**024**	5	1.125	717	BK55	4.9	NONE — 1.125	1B5V124	12.4	B—1.9375	BX56	8
		10	1.375	924	2BK50	4.4	NONE — 1.375	2B5V86	8.6	B—1.9375	(2) BX50	8
		15	1.625	1096	2B5V56	5.7	B — 1.625	2B5V90	9.1	B—1.9375	(2) 5VX530	9
025	**028**	7.5	1.375	773	BK60H	5.4	H — 1.375	1B5V124	12.4	B—1.9375	BX56	10
		10	1.375	962	1B5V60	6.1	H — 1.375	1B5V110	11.1	B—1.9375	5VX570	11
		15	1.625	1106	2B5V54	5.5	B — 1.625	2B5V86	8.7	B—1.9375	(2) 5VX530	9
027	**030**	10	1.375	848	2BK50	4.4	NONE — 1.375	2B5V94	9.4	B—1.9375	(2) BX50	8
		15	1.625	1059	2B5V48	4.9	B — 1.625	2B5V80	8.1	B—1.9375	(2) 5VX500	10
		20	1.625	1187	2B5V58	5.9	B — 1.625	2B5V86	8.7	B—1.9375	(2) 5VX530	11
030	**034**	10	1.375	884	2BK50	4.4	H — 1.375	2B5V90	9.0	B—1.9375	(2) BX50	8
		15	1.625	1096	2B5V56	5.7	B — 1.625	2B5V90	9.1	B—1.9375	(2) 5VX530	9
		20	1.625	1187	2B5V58	5.9	B — 1.625	2B5V86	8.7	B—1.9375	(2) 5VX530	11
035	**038**	10	1.375	779	1B5V60	6.1	NONE — 1.375	1B5V136	13.7	B—1.9375	5VX610	12
		15	1.625	976	2B5V52	5.3	B — 1.625	2B5V94	9.5	B—1.9375	(2) 5VX530	10
		20	1.625	1050	2B5V56	5.7	B — 1.625	2B5V94	9.5	B—1.9375	(2) 5VX550	11
040	**044**	15	1.625	976	2B5V52	5.3	B — 1.625	2B5V94	9.5	B—1.9375	(2) 5VX530	10
		20	1.625	1050	2B5V56	5.7	B — 1.625	2B5V94	9.5	B—1.9375	(2) 5VX550	11
		25	1.875	1182	2B5V74	7.5	B — 1.875	2B5V110	11.1	B—1.9375	(2) 5VX590	11
050	**048**	20	1.625	993	2B5V62	6.3	B — 1.625	2B5V110	11.1	B—1.9375	(2) 5VX570	11
		25	1.875	1134	2B5V80	8.1	B — 1.875	2B5V124	12.5	B—1.9375	(2) 5VX630	11
		30	1.875	1182	2B5V74	7.5	B — 1.875	2B5V110	11.1	B—1.9375	(2) 5VX590	13
—	**054**	15	1.625	741	2B5V46	4.7	B — 1.625	2B5V110	11.1	B—1.9375	(2) 5VX550	11
		20	1.625	962	2B5V60	6.1	B — 1.625	2B5V110	11.1	B—1.9375	(2) 5VX570	12
		25	1.875	1134	2B5V80	8.1	B — 1.875	2B5V124	12.5	B—1.9375	(2) 5VX630	12
—	**058**	20	1.625	930	2B5V58	5.9	B — 1.625	2B5V110	11.1	B—1.9375	(2) 5VX570	13
		25	1.875	1056	2B5V66	6.7	B — 1.875	2B5V110	11.1	B—1.9375	(2) 5VX590	14
		30	1.875	1182	2B5V74	7.5	B — 1.875	2B5V110	11.1	B—1.9375	(2) 5VX590	14
060	**064**	25	1.875	1019	3B5V52	5.3	B — 1.875	3B5V90	9.1	B—1.9375	(3) 5VX530	12
		30	1.875	1134	2B5V80	8.1	B — 1.875	2B5V124	12.5	B—1.9375	(2) 5VX630	14
		40	2.125	1214	2B5V94	9.4	B — 2.125	2B5V136	13.6	B—1.9375	(2) 5VX650	15
—	**068**	25	1.875	938	2B5V66	6.7	B — 1.875	2B5V124	12.5	B—1.9375	(2) 5VX610	14
		30	1.875	1087	3B5V58	5.9	B — 1.875	3B5V94	9.5	B—1.9375	(3) 5VX550	13
		40	2.125	1214	2B5V94	9.4	B — 2.125	2B5V136	13.6	B—1.9375	(2) 5VX650	15

NOTES:
1. Motor shaft speed is 1750 rpm. The fan shaft diameter is $1^{15}/_{16}$ inches.
2. All indoor fan motors meet the minimum efficiency requirements as established by the Energy Policy Act of 1992 (EPACT), effective October 24, 1997.

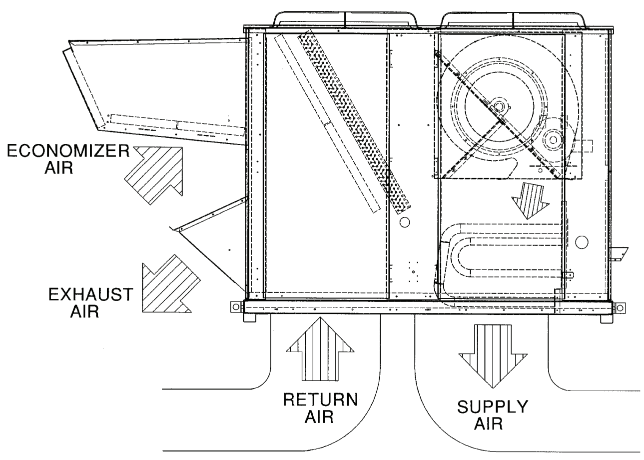


Fig. 18 — Air Distribution — Thru-the-Bottom

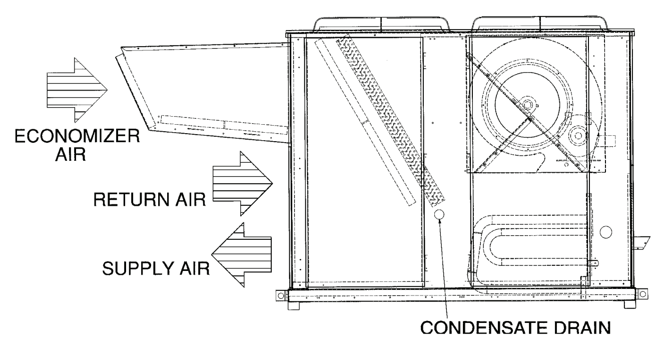


Fig. 19 — Air Distribution — Thru-the-Side

Step 5 — Install Flue Hood

48AJ,AK,AW,AY020-050 AND 48EJ,EK,EW,EY024-048 UNITS — Flue hood is shipped inside gas section of unit. To install, secure flue hood to access panel. See Fig. 20A.

48AJ,AK,AW,AY060 AND 48EJ,EK,EW,EY054-068 UNITS — Flue hood and wind baffle are shipped inside gas section of unit. To install, secure flue hood to access panel. Install the two pieces of the wind baffle over the flue hood. See Fig. 20B.

NOTE: When properly installed, flue hood will line up with combustion fan housing. See Fig. 21.

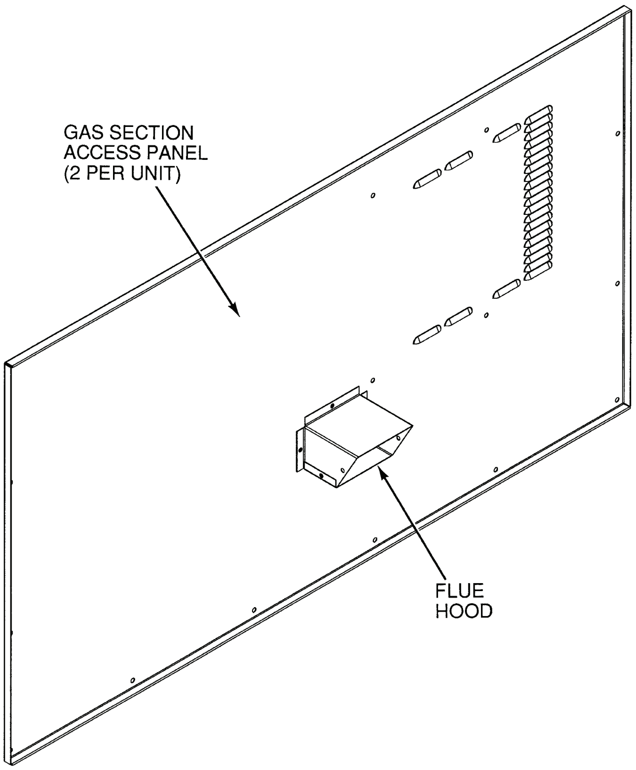


Fig. 20A — Flue Hood Location (48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048 Units)

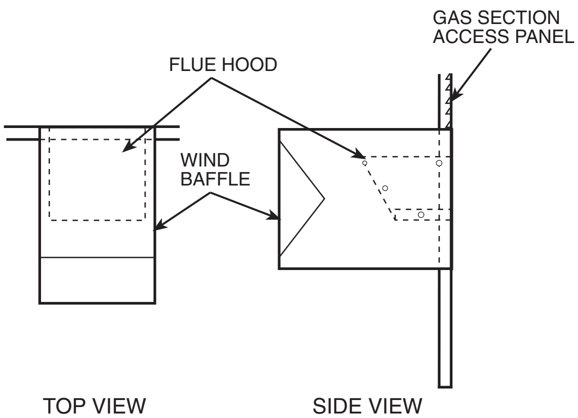


Fig. 20B — Flue Hood Location (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 Units)

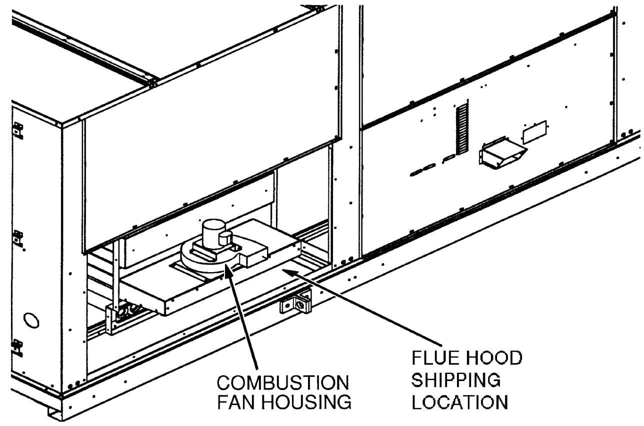


Fig. 21 — Combustion Fan Housing Location

Step 6 — Trap Condensate Drain — See Fig. 5-16

for drain location. Condensate drain is open to atmosphere and must be trapped. Install a trapped drain at the drain location. One 1-in. FPT coupling is provided inside the unit evaporator section for condensate drain connection. A trap at least 4-in. deep must be used. See Fig. 22. Trap must be installed to prevent freeze-up.

Condensate pans are sloped so that water will completely drain from the condensate pan to comply with indoor air quality guidelines. The condensate drain pans are not insulated.

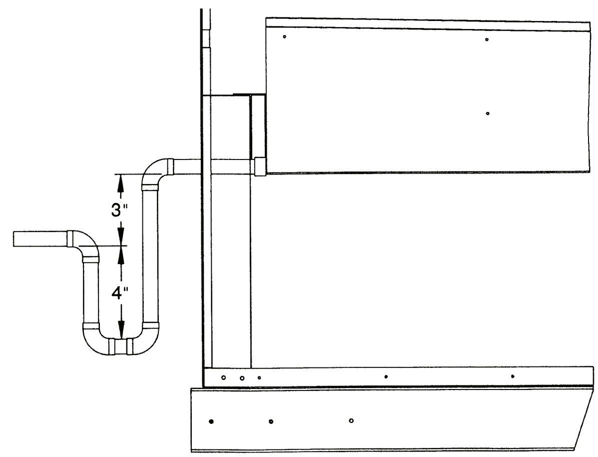


Fig. 22 — Condensate Drain Trap Piping Details (Typical Roof Curb or Slab Mount Shown)

Step 7 — Install Gas Piping — Unit is equipped for

use with natural gas. Installation must conform with local building codes or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1.

Install manual gas shutoff valve with a $^{1}/_{8}$-in. NPT pressure tap for test gage connection at unit. Field gas piping must include sediment trap and union. See Fig. 23. An $^{1}/_{8}$-in. NPT is also located on the gas manifold adjacent to the gas valve.

⚠ WARNING

Do not pressure test gas supply while connected to unit. Always disconnect union before servicing.

IMPORTANT: Natural gas pressure at unit gas connection must not be less than 5 in. wg or greater than 13.5 in. wg.

Size gas-supply piping for 0.5-in. wg maximum pressure drop. Do not use supply pipe smaller than unit gas connection.

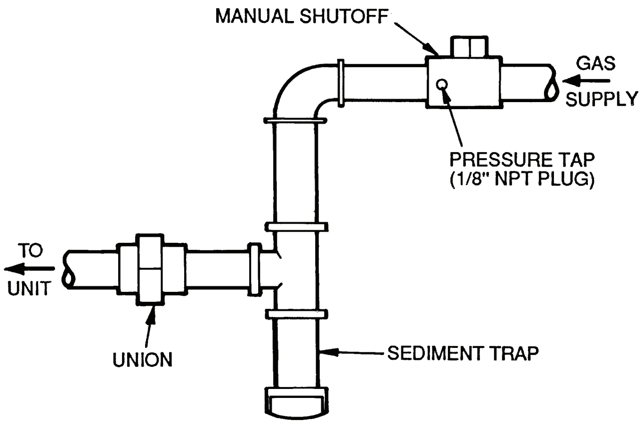


Fig. 23 — Field Gas Piping

OPTIONAL STAGED GAS UNITS — The staging pattern is selected based on Heat Stage Type (HTSTGTYP). Max Capacity per changes default value is selected based on Capacity Maximum Stage (CAPMXSTG). See Table 4.

For complete information and service instructions for Staged Gas Control Units, see Control Operation and Troubleshooting literature.

Step 8 — Controls Options — The control options that the units can provide are based on the following parameters: CV (constant volume) or VAV (variable air volume) operation; stand-alone unit with field-supplied sensors installed (CV or VAV); as a system via Carrier Comfort System (TEMP or VVT® [Variable Volume and Temperature]); optional electronic expansion board installed (CV or VAV); linked to the Carrier Comfort Network; availability of a computer and software (ComfortWORKS® Building Supervisor, and Service Tool) or remote enhanced display accessory installed to access the base control board; and optional factory-installed staged gas control. See Table 5.

NOTE: Access to the base control board allows unit occupancy schedules, unit timeclock, and various set points to be changed from their factory-defined default settings.

Table 4 — 48A,E Series Staged Gas Implementation

NUMBER OF STAGES	MODEL NUMBER POSITION			POSITION		HEAT SIZE
	3	5	6,7,8	HTSTGTYP	CAPMXSTG	
5 stages	E	S	024 028 030 034 038 044 048	Default=1	Default=20	Low
	A	S	020 025 027 030 035 040 050	Default=1	Default=20	Low
	E	T	038 044 048	Default=1	Default=20	High
	A	T	035 040 050	Default=1	Default=20	High
7 stages	E	T	024 028 030 034	Default=2	Default=15	High
	A	T	020 025 027 030	Default=2	Default=15	High
9 stages	E	T	054 058 064 068	Default=3	Default=15	High
	A	T	060	Default=3	Default=15	High
11 stages	E	S	054 058 064 068	Default=4	Default=15	Low
	A	S	060	Default=4	Default=15	Low

Table 5 — Controls Options and Configurations (Non-Thermostat Applications)

UNIT CONFIGURATION	DEFAULT COOLING	DEFAULT HEATING
CV or VAV Unit with SPT Sensor	Unoccupied Cooling — 90 F (32 C) (SPT) Occupied Cooling — NA	Unoccupied Heating — 55 F (13 C) (SPT) Occupied Heating — NA
CV Unit with SPT Sensor and Remote Start/Stop Switch	Unoccupied Cooling — 90 F (32 C) (SPT) Occupied Cooling — 78 F (26 C) (SPT)	Unoccupied Heating — 55 F (13 C) (SPT) Occupied Heating — 68 F (20 C) (SPT)
VAV Unit Remote Start/Stop Switch Only	Unoccupied Cooling — 90 F (32 C)(SPT) Occupied Cooling — 55 F (13 C) SPT)	Unoccupied Heating — 55 F (13 C) (RAT) Occupied Heating — 68 F (20 C) (RAT)*
VAV Unit with SPT Sensor and Remote Start/Stop Switch	Unoccupied Cooling — 90 F (32 C) (SPT) Occupied Cooling — 55 F (13 C) (SAT)	Unoccupied Heating — 55 F (13C) (SPT) Occupied Heating — 68 F (20 C) (RAT)*

LEGEND

CV — Constant Volume
NA — Not Available
RAT — Return-Air Temperature
SAT — Supply-Air Temperature
SPT Space Temperature
VAV — Variable Air Volume

*With DIP Switch No. 5 configured to OPEN (Occupied Heat Enabled).

NOTE: Space temperature sensor and remote start/stop switch are field-supplied.

STAGED GAS UNIT APPLICATIONS — The rooftop units may be ordered with an optional factory-installed staged gas control system that monitors heating operation of the rooftop unit.

IMPORTANT: An accessory field-supplied Navigator display module is required for all staged gas control units.

Install Supply-Air Thermistors (Staged Gas Units Only) — Supply-air thermistors are a field-installed factory-provided component. Three supply-air thermistors are shipped with staged gas units and are inside the heating section. Thermistor wires must be connected to SGC (staged gas controller) in the heating section. See Table 6 and Fig 24. The supply-air thermistors should be located in the supply duct with the following criteria:

- downstream of the heat exchanger cells
- equally spaced as far as possible from the heat exchanger cells
- a duct location where none of the supply air thermistors are within sight of the heat exchanger cells
- a duct location with good mixed supply air portion of the unit.

THERMISTORS — All units are equipped with a supply air thermistor (SAT) located in the supply fan discharge and an outdoor air thermistor (OAT) located in the outdoor air hood. Variable air volume (VAV) units are supplied with a return air thermistor (RAT) located on the return air damper support.

CONSTANT VOLUME APPLICATIONS — The units, as shipped, are operable as stand-alone units, using either a standard (mechanical or electronic) 2-stage heat, 2-stage cool thermostat, or with an electronic room sensor and a timeclock to establish unit start and stop times.

With a standard thermostat (programmable is optional), heating and cooling operation is set by space temperature.

With a space sensor and timeclock, the machine will operate at default values unless they are changed using appropriate input devices. The space sensor senses space temperature and may be equipped with a timed override feature, which allows unit operation during unoccupied periods.

The space sensors may be used in multiples of 4 or 9 to achieve space temperature averaging. The use of a space sensor also allows the unit to be turned on and off from a remote signal.

Table 6 — Thermistor Designations

THERMISTOR	PIN CONNECTION POINT	FUNCTION AND LOCATION	PART NO.
		Thermistors	
SAT 1	J8 – 1,2 (SGC)	Supply Air Thermistor (SAT) — Inserted into supply section underneath the gas heat section (factory-provided, field-installed)	HH79NZ016
SAT 2	J8 – 3,4 (SGC)	Supply Air Thermistor (SAT) — Inserted into supply section underneath the gas heat section (factory-provided, field-installed)	
SAT 3	J8 – 5,6 (SGC)	Supply Air Thermistor (SAT) — Inserted into supply section underneath the gas heat section (factory-provided, field-installed)	

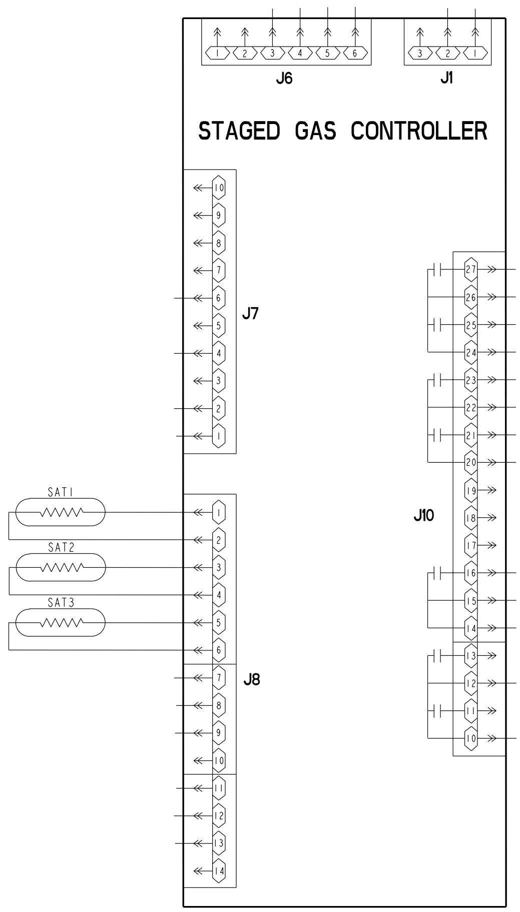


Fig. 24 — Supply-Air Thermistor Connections

Features with Thermostat Control of Unit

- two-stage heating
- two-stage cooling
- control of unit using Y1, Y2, W1, W2, and G thermostat inputs
- control of the indoor fan
- outdoor-air temperature/supply-air temperature monitoring
- control of an outdoor air condenser fan based on outdoor-air temperature
- control of modulating economizer damper to provide free cooling when outdoor conditions are suitable, using supply-air temperature as a control point
- control of the economizer damper and indoor fan to obtain unoccupied free cooling
- provide power exhaust output to an external power exhaust controller
- support a field test for field checkout
- control of 2 stages of CV power exhaust
- compressor Time Guard® (power up, minimum off and on times)
- compressor lockout during low supply-air temperature

Additional features are provided by accessing the standard unit control board via software with a computer. These features are:

- electronic expansion board features (if installed)
- control board diagnostics
- ability to change supply air set point (economizer control)
- ability to change high outdoor temperature lockout set point (economizer control)
- ability to change power exhaust set points

NOTE: A CV unit without a thermostat requires a field-supplied sensor for operation.

Features with Sensor Control of Unit (Stand-Alone Applications — Unit control is limited to CV unoccupied default set points, 90 F for cooling, 55 F for heating unless a computer has been used to change the set points. There are 2 sensor options available:

- T-55 sensor will monitor room temperature and provide unoccupied override capability (1 hour)
- T-56 sensor will monitor room temperature, provide unoccupied override capability (1 hour), and provide a temperature offset of 5° F.

Standard features are:

- support of remote occupied/unoccupied input to start and stop the unit
- cooling capacity control of 3 stages using economizer and 2 compressors to maintain space temperature to an occupied or unoccupied set point
- enable heating or cooling during unoccupied periods as required to maintain space temperature within the unoccupied set points
- adjustment of space temperature set points of ±5° F when using a T-56 sensor
- provides CCN (Carrier Comfort Network) IAQ (Indoor-Air Quality) participation
- control of modulating economizer damper to maintain indoor air quality (IAQ) when outdoor conditions are suitable (this function is provided in the base unit controls on units with serial number 0600F or later)

NOTE: The IAQ sensor must be set for current output (4 to 20 mA), not voltage output. Ensure the jumper on the sensor is in the upper position. See Fig. 25.

Additional features with sensor control of unit (with computer access or Remote Enhanced Display) are:

- 365-day timeclock with backup (supports minute, hour, day of week, date, month, and year)
- daylight savings time function
- occupancy control with 8 periods for unit operation
- holiday table containing up to 18 holiday schedules
- ability to initiate timed override from T-55 or T-56 sensors for a timed period of 1 to 4 hours
- ability to use multiple space temperature sensors to average the space temperature
- supply-air temperature reset for the supply-air temperature set point
- temperature compensated start to calculate early start times before occupancy
- access to the Display, Maintenance, Configuration, Service, and Set Point data tables through network software
- loadshed and demand limiting

When the unit is equipped with a field-supplied space temperature sensor and a remote contact closure (remote start/stop) on the base control board, the occupied default set points will monitor unit operation. The occupied default set points are 78 F cooling and 68 F heating (if heating is present). See Fig. 26 for remote start/stop wiring.

NOTE: For units with a field-supplied space temperature sensor which have not had the base unit control board accessed via software to set an occupancy schedule, the remote start/stop closure will allow the unit to operate in the pre-configured occupied default set points of 78 F cooling and 68 F heating. Without this feature, the unit will control to the unoccupied default set points of 90 F cooling and 55 F heating.

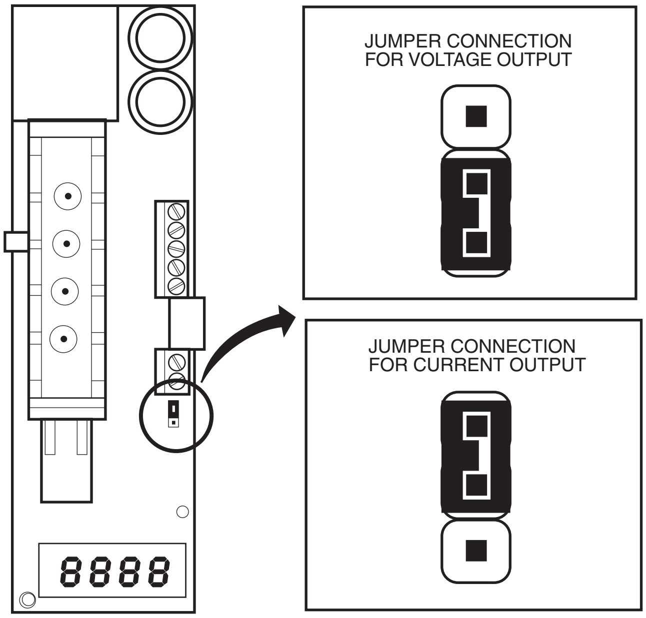


Fig. 25 — Indoor Air Quality Sensor Configuration

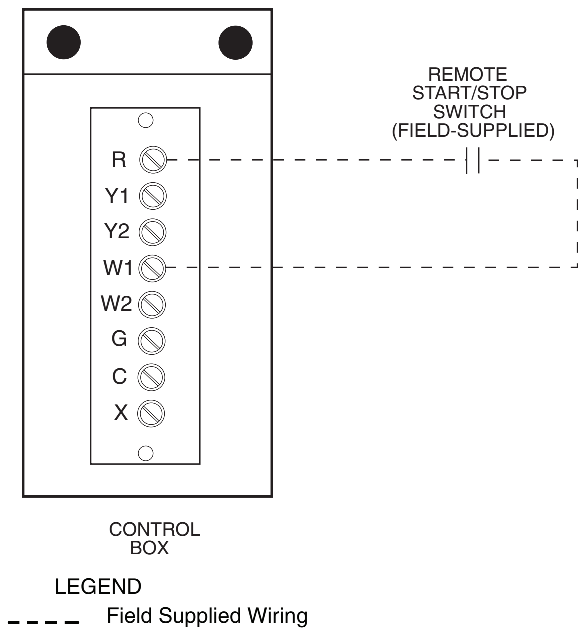


Fig. 26 — Field Control Remote Start/Stop

An electronic expansion board may be field-installed to provide the following features:

- provide discrete inputs for fan status, filter status, field-applied status, and demand limit
- provide an output for the external alarm light indicator
- provide power exhaust fire outputs for direct control of modulated power exhaust stages during fire or smoke modes
- control of smoke control modes including evacuation, smoke purge, pressurization, and fire shutdown (modulating power exhaust required)

When the unit is connected to the CCN (Carrier Comfort Network), the following expansion board features can be utilized:

- perform Demand Limit functions based on CCN load-shed commands or the state of the discrete input
- alarm monitoring of all key parameters
- CCN protocol

See Carrier TEMP or VVT® (Variable Volume and Temperature) literature for complete TEMP (single zone) or VVT (multi-zone) application information.

Features with Sensor Control of Unit (Network Applications) — The base control board provides, as standard, a connection for use with a Carrier VVT system and can also be integrated into a Carrier Comfort Network.

When the unit is accessed via a PC equipped with ComfortWORKS®, Building Supervisor, Service Tool software, or accessory Remote Enhanced Display, the following features can be accessed:

- on-board timeclock can be programmed
- occupancy schedules can be programmed
- unit set points can be changed
- alarms can be monitored

This access is available on the base control board via a RJ-11 phone jack or a 3-wire connection to the communication bus. See Fig. 27. The timeclock has a 10-hour minimum back-up time to provide for unit power off for servicing unit or during unexpected power outages. For complete Carrier Comfort System (CCS) or Carrier Comfort Network (CCN) features and benefits, refer to the product literature.

VARIABLE AIR VOLUME (VAV) APPLICATIONS

Features with Stand-Alone Applications — The units, as shipped, are operable as stand-alone units with the addition of a timeclock to establish unit start and stop times.

Heating and cooling in both on and off modes is controlled to default values by the base unit control. Set points may be changed with appropriate input devices.

The control has an on-board occupancy schedule which can be set using an input device and eliminates the need for an external timeclock.

During both the on and off periods, cooling operation is controlled to the supply air setting and heating is controlled to the return air setting (or to the optional space temperature sensor). During the on period, the supply fan runs continuously. During the off period, the supply fan will be activated if the return air sensor is outside of the set points and will run long enough to accurately sample the space temperature. The supply fan will then continue to run until any heating or cooling load is satisfied, at which point it will turn off.

The use of a space sensor will allow for supply air reset to conserve energy and maintain comfort. If equipped with an override feature, the sensor will allow operation during the off period for a fixed length of time.

Base unit control supports a Heat Interlock Relay (field supplied) to fully open the VAV terminal devices during heating operation.

Standard features of a VAV unit with a remote start/stop switch are:

- control board diagnostics
- control of an outdoor condenser fan based upon outdoor air temperature
- control of modulating economizer to provide free cooling when outdoor conditions are suitable, using supply-air temperature as a set point
- support of remote occupied/unoccupied input to start or stop the unit
- provide power exhaust output to an external power exhaust controller
- support supply-air temperature reset to offset supply air set point
- support a field test for field check out
- support linkage to DAV (digital air volume) systems
- cooling capacity control of up to 6 stages plus economizer with compressors and unloaders to maintain supply air temperature set point during occupied periods

- control of one stage of heat to maintain return-air temperature at heating set point during occupied periods
- provide a variable frequency drive high voltage relay output to enable VFD
- control of heat interlock relay
- IAQ (Indoor Air Quality) sensor
- OAQ (Outdoor Air Quality) sensor
- DX compressor lockout occurs at 45 F outdoor air temperature and is factory-enabled on units with serial number 0600F or later. This feature may be disabled through the use of a computer
- compressor Time Guard® override (power up, minimum off and on times)

With the addition of a remote start/stop switch heating or cooling is enabled during unoccupied periods as required to maintain space temperature to within unoccupied set points.

Occupied heating is enabled or disabled by the position of DIP (dual in-line package) switch no. 5.

Additional features may be provided with Electronic Access to Unit Control Board. These features are:

- additional control board diagnostics
- electronic expansion board features (if installed)
- control of the economizer damper and indoor fan to obtain unoccupied free cooling
- 365-day timeclock with backup (supports minute, hour, day, month, and year)
- holiday table containing up to 18 holiday schedules
- occupancy control with 8 periods for unit operation
- support a set of display, maintenance, configuration, service, and set point data tables for interface with Building Supervisor, ComfortWORKS®, or Service Tool software or accessory remote enhanced display
- CCN IAQ/OAQ (outdoor air quality) participation

When a VAV unit with a space temperature sensor is accessed via a computer, the following additional features are available:

- ability to initiate timed override from T-55 sensors
- temperature compensated start to calculate early start time before occupancy
- provide space temperature reset to reset the supply air set point upward when the temperature falls below the occupied cooling set point

An electronic expansion board may be field-installed to provide the following features:

- fan status
- filter status
- field-applied status
- demand limiting
- alarm light
- fire unit shutdown
- fire pressurization
- fire evacuation
- fire smoke purge

When the unit is connected to the CCN (Carrier Comfort Network), the following features can be utilized:

- CCN demand limit participation
- modulated power exhaust override
- ability to use multiple space temperature sensors (multiples of 4 and 9 only) to average space temperature (CV and VAV only)

A field-supplied T-55 space temperature sensor can be added to monitor room temperature and provide unoccupied override capability (1 hour).

When the unit is equipped with a field-supplied space temperature sensor and a remote contact closure (remote start/stop) the occupied default set points will monitor unit operation. The occupied default set points are 55 F (supply-air temperature) cooling and 68 F (return-air temperature) heating. See Fig. 26 for remote start/stop wiring.

NOTE: For units without a space temperature sensor and which have not had the base unit control board accessed via software to set an occupancy schedule, the remote start/stop closure will allow the unit to operate in the pre-configured occupied default set points of 55 F (supply-air temperature) cooling and 68 F (return-air temperature) heating. Without an occupancy schedule, the unit will control to the unoccupied default set points of 90 F (return-air temperature) cooling and 55 F (return-air temperature) heating.

Features with Network Applications — The base control board provides, as standard, a connection for use with a Carrier Comfort System and can also be integrated into a Carrier Comfort Network (CCN). When the unit is accessed via a PC equipped with ComfortWORKS, Building Supervisor, or Service Tool software or Remote Enhanced Display accessory, the following features can be accessed:

- on-board timeclock can be programmed
- occupancy schedules can be programmed
- unit set points can be changed
- alarms can be monitored

This access is available on the base control board via a RJ-11 phone jack or a 3-wire connection to the communication bus. See Fig. 27. The internal timeclock has a 10-hour minimum back-up time to provide for unit power off for servicing unit or during unexpected power outages. For complete Carrier Comfort System (CCS) or Carrier Comfort Network (CCN) features and benefits, refer to the product literature.

Step 9 — Make Electrical Connections

POWER WIRING — Units are factory wired for the voltage shown on the unit nameplate.

When installing units, provide a disconnect per NEC (National Electrical Code) of adequate size (MOCP [maximum overcurrent protection] of unit is on the informative plate). All field wiring must comply with NEC and all local codes and requirements. Size wire based on MCA (minimum circuit amps) on the unit informative plate. See Fig. 28 for power wiring connections to the unit power terminal block and equipment ground.

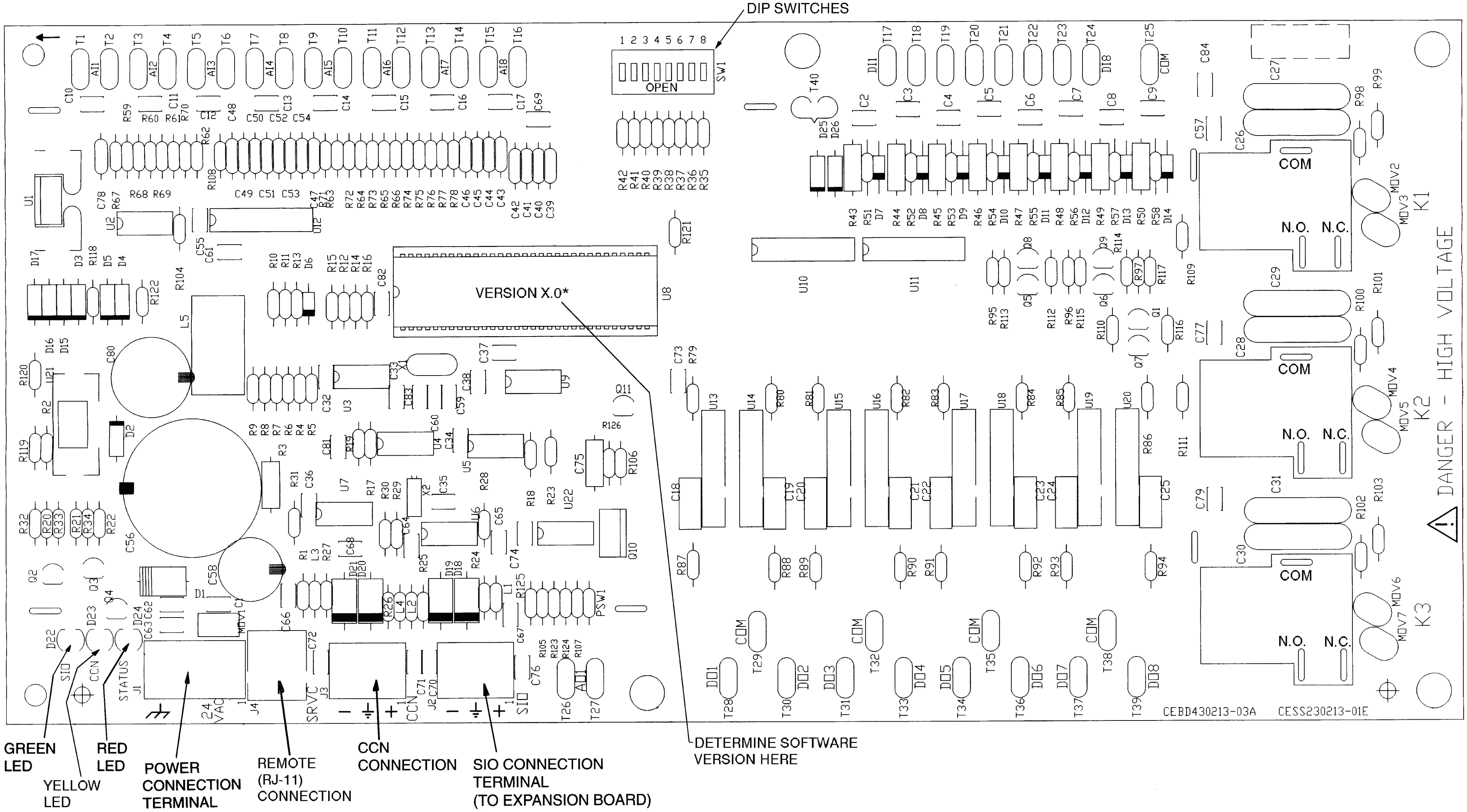
The main power terminal block is suitable for use with aluminum or copper wire. See Fig. 28. Units have circuit breakers for compressors, fan motors, and control circuit. If required by local codes, provide an additional disconnect switch. Whenever external electrical sources are used, unit must be electrically grounded in accordance with local codes, or in absence of local codes, with NEC, ANSI (American National Standards Institute) C1-latest year.

FIELD POWER SUPPLY — Unit is factory wired for voltage shown on unit nameplate. See Table 7 and 8 for electrical data.

Field wiring can be brought into the unit from bottom (through basepan and roof curb) or through side of unit (corner post next to control box).

A $3^1/_2$-in. NPT coupling for field power wiring and a $^3/_4$-in. NPT coupling for 24-v control wiring are provided in basepan. In the side post, there are two $2^1/_2$-in. (48A020-030 and 48E024-034) or 3-in. (48A035-060 and 48E038-068) knockouts for the field power wiring. See Fig. 5-16. If control wiring is to be brought in through the side of unit, a $^7/_8$-in. diameter hole is provided in the condenser side post next to the control box.

If disconnect box is mounted to corner post, be careful not to drill any screws into the condenser coil.



LEGEND

CCN	— Carrier Comfort Network	**N.O.**	— Normally Open
COM	— Common	**R**	— Relay
D	— Diode	**SIO**	— Serial Input/Output
DIP	— Dual In-Line Package	**SW**	— Switch
LED	— Light-Emitting Diode	**T**	— Terminal
N.C.	— Normally Closed		

*Where X is the unit control software version number.

Fig. 27 — Control Board Diagram

Table 7 — Electrical Data — 48AJ,AK,AW,AY Units

UNIT SIZE 48AJ,AK, AW,AY	NOMINAL VOLTAGE (3 PH, 60 Hz)	VOLTAGE RANGE		COMPRESSOR				OFM		IFM		POWER EXHAUST	POWER SUPPLY	
				No. 1		No. 2								
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA	Hp	FLA	FLA (total)	MCA	MOCP*
020	208/230	187	253	39.1	228	25.6	160	2	5.3 (ea)	5	16.7/15.2	—	101.8/100.3	125/125
												23.6/23.6	125.4/123.9	150/150
										10	30.8/28.0	—	115.9/113.1	150/150
												23.6/23.6	139.5/136.7	175/175
										15	46.2/42.0	—	133.1/127.8	175/150
												23.6/23.6	156.7/151.4	200/175
	460	414	508	19.9	114	11.5	80	2	2.7 (ea)	5	7.6	—	49.4	60
												12.6	62.0	80
										10	14	—	55.8	70
												12.6	68.4	80
										15	21	—	63.1	80
												12.6	75.7	90
	575	518	632	16	91	9.6	64	2	2.4 (ea)	5	6.1	—	40.5	50
												12.6	53.1	60
										10	11	—	45.4	60
												12.6	58.0	70
										15	17	—	51.7	60
												12.6	64.3	80
025	208/230	187	253	39.1	228	39.1	256	2	5.3 (ea)	7.5	24.2/22.0	—	122.8/120.6	150/150
												23.6/23.6	146.4/144.2	175/175
										10	30.8/28.0	—	129.4/126.6	150/150
												23.6/23.6	153.0/150.2	175/175
										15	46.2/42.0	—	146.6/141.3	175/175
												23.6/23.6	170.2/164.9	200/200
	460	414	508	19.9	114	19.9	114	2	2.7 (ea)	7.5	11	—	61.2	80
												12.6	73.8	90
										10	14	—	64.2	80
												12.6	76.8	90
										15	21	—	71.5	90
												12.6	84.1	100
	575	518	632	16	91	16	91	2	2.4 (ea)	7.5	9	—	49.8	60
												12.6	62.4	70
										10	11	—	51.8	60
												12.6	64.4	80
										15	17	—	58.1	70
												12.6	70.7	80

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

*Fuse or HACR circuit breaker per NEC.

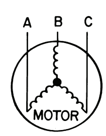
NOTES:

1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The Canadian units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent of voltage imbalance.

% Voltage imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\text{\% Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Table 7 — Electrical Data — 48AJ,AK,AW,AY Units (cont)

UNIT SIZE 48AJ,AK, AW,AY	NOMINAL VOLTAGE (3 PH, 60 Hz)	VOLTAGE RANGE		COMPRESSOR				OFM		IFM		POWER EXHAUST	POWER SUPPLY	
				No. 1		No. 2								
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA	Hp	FLA	FLA (total)	MCA	MOCP*
027	208/230	187	253	39.1	256	39.1	256	2	5.3 (ea)	10	30.8/28.0	—	129.4/126.6	150/150
												23.6/23.6	153.0/150.2	175/175
										15	46.2/42.0	—	146.6/141.3	175/175
												23.6/23.6	170.2/164.9	200/200
										20	59.4/54.0	—	163.1/156.3	200/200
												23.6/23.6	186.7/179.9	225/225
	460	414	508	19.9	114	19.9	114	2	2.7 (ea)	10	14	—	64.2	80
												12.6	76.8	90
										15	21	—	71.5	90
												12.6	84.1	100
										20	27	—	79.0	100
												12.6	91.6	110
	575	518	632	16	91	16	91	2	2.4 (ea)	10	11	—	51.8	60
												12.6	64.4	80
										15	17	—	58.1	70
												12.6	70.7	80
										20	22	—	64.3	80
												12.6	76.9	90
030	208/230	187	253	57.1	266	39.1	228	2	5.3 (ea)	10	30.8/28.0	—	151.9/149.1	200/200
												23.6/23.6	175.5/172.7	225/225
										15	46.2/42.0	—	167.3/163.1	200/200
												23.6/23.6	190.9/186.7	225/225
										20	59.4/54.0	—	181.1/175.1	225/225
												23.6/23.6	204.7/198.7	250/250
	460	414	508	25.6	120	19.9	114	2	2.7 (ea)	10	14	—	71.3	90
												12.6	83.9	100
										15	21	—	78.3	100
												12.6	90.9	110
										20	27	—	84.7	110
												12.6	97.3	110
	575	518	632	20.5	96	16	91	2	2.4 (ea)	10	11	—	57.4	70
												12.6	70.0	90
										15	17	—	63.4	80
												12.6	76.0	90
										20	22	—	68.8	90
												12.6	81.4	100

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

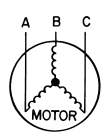
*Fuse or HACR circuit breaker per NEC.

NOTES:
1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The Canadian units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent of voltage imbalance.

% Voltage imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\text{\% Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Table 7 — Electrical Data — 48AJ,AK,AW,AY Units (cont)

UNIT SIZE 48AJ,AK, AW,AY	NOMINAL VOLTAGE (3 PH, 60 Hz)	VOLTAGE RANGE		COMPRESSOR				OFM		IFM		POWER EXHAUST	POWER SUPPLY	
				No. 1		No. 2								
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA	Hp	FLA	FLA (total)	MCA	MOCP*
035	208/230	187	253	57.1	266	57.1	266	4	5.3 (ea)	10	30.8/28.0	—	180.5/177.7	225/225
												23.6/23.6	204.1/201.3	250/250
										15	46.2/42.0	—	195.9/191.7	250/225
												23.6/23.6	219.5/215.3	250/250
										20	59.4/54.0	—	209.7/203.7	250/250
												23.6/23.6	233.3/227.3	250/250
	460	414	508	25.6	120	25.6	120	4	2.7 (ea)	10	14	—	82.4	100
												12.6	95.0	110
										15	21	—	89.4	110
												12.6	102.0	125
										20	27	—	95.8	110
												12.6	108.4	125
	575	518	632	20.5	96	20.5	96	4	2.4 (ea)	10	11	—	66.7	80
												12.6	79.3	90
										15	17	—	72.7	90
												12.6	85.3	100
										20	22	—	78.1	100
												12.6	90.7	110
040	208/230	187	253	57.1	266	69.2	345	4	5.3 (ea)	15	46.2/42.0	—	211.0/206.8	250/250
												23.6/23.6	234.6/230.4	300/250
										20	59.4/54.0	—	224.2/218.8	250/250
												23.6/23.6	247.8/242.4	300/300
										25	74.8/68.0	—	241.0/232.8	300/300
												23.6/23.6	264.6/256.4	300/300
	460	414	508	25.6	120	28.8	173	4	2.7 (ea)	15	21	—	93.4	110
												12.6	106.0	125
										20	27	—	99.4	125
												12.6	112.0	125
										25	34	—	107.7	125
												12.6	120.3	150
	575	518	632	20.5	96	26.7	120	4	2.4 (ea)	15	17	—	80.5	100
												12.6	93.1	110
										20	22	—	85.5	110
												12.6	98.1	110
										25	27	—	90.6	110
												12.6	103.2	125

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

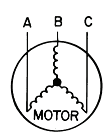
*Fuse or HACR circuit breaker per NEC.

NOTES:
1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The Canadian units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent of voltage imbalance.

   % Voltage imbalance

   $$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\text{\% Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Table 7 — Electrical Data — 48AJ,AK,AW,AY Units (cont)

UNIT SIZE 48AJ,AK, AW,AY	NOMINAL VOLTAGE (3 PH, 60 Hz)	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		OFM		IFM		POWER EXHAUST	POWER SUPPLY	
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA	Hp	FLA	FLA (total)	MCA	MOCP*
050	208/230	187	253	69.2	345	69.2	345	4	5.3 (ea)	20	59.4/54.0	—	236.3/230.9	300/300
												23.6/23.6	259.9/254.5	300/300
										25	74.8/68.0	—	253.1/244.9	300/300
												23.6/23.6	276.7/268.5	350/300
										30	88/80.0	—	269.6/259.6	350/300
												23.6/23.6	293.2/283.2	350/350
	460	414	508	28.8	173	28.8	173	4	2.7 (ea)	20	27	—	102.6	125
												12.6	115.2	125
										25	34	—	110.9	125
												12.6	123.5	150
										30	40	—	118.4	150
												12.6	131.0	150
	575	518	632	26.7	120	26.7	120	4	2.4 (ea)	20	22	—	91.7	110
												12.6	104.3	125
										25	27	—	96.8	110
												12.6	109.4	125
										30	32	—	103.0	125
												12.6	115.6	125
060	208/230	187	253	82.1	446	82.1	446	6	5.3 (ea)	25	74.8/68.0	—	291.3/284.5	350/350
												35.4/35.4	326.7/319.9	400/400
										30	88/80.0	—	306.0/296.5	350/350
												35.4/35.4	341.4/331.9	400/400
										40	114/104	—	338.5/326.0	450/400
												35.4/35.4	373.9/361.4	450/450
	460	414	508	43.6	223	43.6	223	6	2.7 (ea)	25	34	—	148.3	175
												18.9	167.2	200
										30	40	—	154.3	175
												18.9	173.2	200
										40	52	—	168.4	200
												18.9	187.3	225
	575	518	632	34.6	164	34.6	164	6	2.4 (ea)	25	27	—	119.3	150
												18.9	138.2	150
										30	32	—	124.3	150
												18.9	143.2	175
										40	41	—	134.9	175
												18.9	153.8	175

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

*Fuse or HACR circuit breaker per NEC.

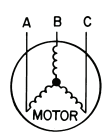
NOTES:

1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The Canadian units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent of voltage imbalance.

   % Voltage imbalance

   $$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\%\ \text{Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

> IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Table 8 — Electrical Data — 48EJ,EK,EW,EY Units

UNIT SIZE 48EJ,EK, EW,EY	NOMNAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR				OFM			IFM		POWER EXHAUST		COMBUSTION FAN MOTOR	POWER SUPPLY	
				No. 1		No. 2											
		Min	Max	RLA	LRA	RLA	LRA	Qty	Hp	FLA (ea)	Hp	FLA	FLA	LRA	FLA	MCA	MOCP*
024	208/230	187	254	39.1	228	25.6	160	2	1	5.3	5	16.7/ 15.2	—	—	0.96	101.8/100.3	125/125
													23.6	41.6	0.96	125.4/123.9	150/150
											10	30.8/ 28.0	—	—	0.96	115.9/113.1	150/150
													23.6	41.6	0.96	139.5/136.7	175/175
											15	46.2/ 42.0	—	—	0.96	131.3/127.1	150/150
													23.6	41.6	0.96	154.9/150.7	175/175
	460	414	508	19.9	114	11.5	80	2	1	2.7	5	7.6	—	—	0.5	49.4	60
													12.6	23.6	0.5	62.0	80
											10	14.0	—	—	0.5	55.8	70
													12.6	23.6	0.5	68.4	80
											15	21.0	—	—	0.5	62.8	80
													12.6	23.6	0.5	75.4	90
	575	518	632	16.0	91	9.6	64	2	1	2.4	5	6.1	—	—	0.5	40.5	50
													12.6	23.6	0.5	53.1	60
											10	11.0	—	—	0.5	45.4	60
													12.6	23.6	0.5	58.0	70
											15	17.0	—	—	0.5	51.4	60
													12.6	23.6	0.5	64.0	80
028	208/230	187	254	39.1	228	39.1	228	2	1	5.3	7.5	24.2/ 22.0	—	—	0.96	122.8/120.6	150/150
													23.6	41.6	0.96	146.4/144.2	175/175
											10	30.8/ 28.0	—	—	0.96	129.4/126.6	150/150
													23.6	41.6	0.96	153.0/150.2	175/175
											15	46.2/ 42.0	—	—	0.96	144.8/140.6	175/175
													23.6	41.6	0.96	168.4/164.2	200/200
	460	414	508	19.9	114	19.9	114	2	1	2.7	7.5	11.0	—	—	0.5	61.2	80
													12.6	23.6	0.5	73.8	90
											10	14.0	—	—	0.5	64.2	80
													12.6	23.6	0.5	76.8	90
											15	21.0	—	—	0.5	71.2	90
													12.6	23.6	0.5	83.8	100
	575	518	632	16.0	91	16.0	91	2	1	2.4	7.5	9.0	—	—	0.5	49.8	60
													12.6	23.6	0.5	62.4	70
											10	11.0	—	—	0.5	51.8	60
													12.6	23.6	0.5	64.4	80
											15	17.0	—	—	0.5	57.8	70
													12.6	23.6	0.5	70.4	80
030	208/230	187	254	57.1	266	39.1	228	2	1	5.3	10	30.8/ 28.0	—	—	0.96	151.9/149.1	200/200
													23.6	41.6	0.96	175.5/172.7	225/225
											15	46.2/ 42.0	—	—	0.96	167.3/163.1	225/225
													23.6	41.6	0.96	190.9/186.7	225/225
											20	59.4/ 54.0	—	—	0.96	180.5/175.1	225/225
													23.6	41.6	0.96	204.1/198.7	250/250
	460	414	508	25.6	120	19.9	114	2	1	2.7	10	14.0	—	—	0.5	71.3	90
													12.6	23.6	0.5	83.9	100
											15	21.0	—	—	0.5	78.3	100
													12.6	23.6	0.5	90.9	110
											20	27.0	—	—	0.5	84.3	100
													12.6	23.6	0.5	96.9	110
	575	518	632	20.5	96	16.0	91	2	1	2.4	10	11.0	—	—	0.5	57.4	70
													12.6	23.6	0.5	70.0	90
											15	17.0	—	—	0.5	63.4	80
													12.6	23.6	0.5	76.0	90
											20	22.0	—	—	0.5	68.4	80
													12.6	23.6	0.5	81.0	100

See Legend and Notes on page 42.

Table 8 — Electrical Data — 48EJ,EK,EW,EY Units (cont)

UNIT SIZE 48EJ,EK, EW,EY	NOMNAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		OFM			IFM		POWER EXHAUST		COMBUSTION FAN MOTOR	POWER SUPPLY	
		Min	Max	RLA	LRA	RLA	LRA	Qty	Hp	FLA (ea)	Hp	FLA	FLA	LRA	FLA	MCA	MOCP*
034	208/230	187	254	57.1	266	57.1	266	2	1	5.3	10	30.8/ 28.0	—	—	0.96	169.9/167.1	225/200
													23.6	41.6	0.96	193.5/190.7	250/225
											15	46.2/ 42.0	—	—	0.96	185.3/181.1	200/200
													23.6	41.6	0.96	208.9/204.7	250/250
											20	59.4/ 54.0	—	—	0.96	198.5/193.1	250/250
													23.6	41.6	0.96	222.1/216.7	275/250
	460	414	508	25.6	120	25.6	120	2	1	2.7	10	14.0	—	—	0.5	77.0	100
													12.6	23.6	0.5	89.6	110
											15	21.0	—	—	0.5	84.0	100
													12.6	23.6	0.5	96.6	110
											20	27.0	—	—	0.5	90.0	110
													12.6	23.6	0.5	102.6	125
	575	518	632	20.5	96	20.5	96	2	1	2.4	10	11.0	—	—	0.5	61.9	80
													12.6	23.6	0.5	74.5	90
											15	17.0	—	—	0.5	67.9	80
													12.6	23.6	0.5	80.5	100
											20	22.0	—	—	0.5	72.9	90
													12.6	23.6	0.5	85.5	100
038	208/230	187	254	57.1	266	57.1	266	4	1	5.3	10	30.8/ 28.0	—	—	0.96	180.5/177.7	225/225
													23.6	41.6	0.96	204.1/201.3	250/250
											15	46.2/ 42.0	—	—	0.96	195.9/191.7	250/225
													23.6	41.6	0.96	219.5/215.3	275/250
											20	59.4/ 54.0	—	—	0.96	209.1/203.7	250/250
													23.6	41.6	0.96	232.7/227.3	275/275
	460	414	508	25.6	120	25.6	120	4	1	2.7	10	14.0	—	—	0.5	82.4	100
													12.6	23.6	0.5	95.0	110
											15	21.0	—	—	0.5	89.4	110
													12.6	23.6	0.5	102.0	125
											20	27.0	—	—	0.5	95.4	110
													12.6	23.6	0.5	108.0	125
	575	518	632	20.5	96	20.5	96	4	1	2.4	10	11.0	—	—	0.5	66.7	80
													12.6	23.6	0.5	79.3	90
											15	17.0	—	—	0.5	72.7	90
													12.6	23.6	0.5	85.3	100
											20	22.0	—	—	0.5	77.7	90
													12.6	23.6	0.5	90.3	110
044	208/230	187	254	69.2	345	69.2	345	4	1	5.3	15	46.2/ 42.0	—	—	0.96	223.1/218.9	275/275
													23.6	41.6	0.96	246.7/242.5	300/300
											20	59.4/ 54.0	—	—	0.96	236.3/230.9	300/300
													23.6	41.6	0.96	259.9/254.5	300/300
											25	74.8/ 68.0	—	—	0.96	251.7/244.9	300/300
													23.6	41.6	0.96	275.3/268.5	300/300
	460	414	508	28.8	173	28.8	173	4	1	2.7	15	21.0	—	—	0.5	96.6	125
													12.6	23.6	0.5	109.2	125
											20	27.0	—	—	0.5	102.6	125
													12.6	23.6	0.5	115.2	125
											25	34.0	—	—	0.5	109.6	125
													12.6	23.6	0.5	122.2	150
	575	518	632	26.7	120	26.7	120	4	1	2.4	15	17.0	—	—	0.5	86.7	110
													12.6	23.6	0.5	99.3	125
											20	22.0	—	—	0.5	91.7	110
													12.6	23.6	0.5	104.3	125
											25	27.0	—	—	0.5	96.7	110
													12.6	23.6	0.5	109.3	125

See Legend and Notes on page 42.

Table 8 — Electrical Data — 48EJ,EK,EW,EY Units (cont)

UNIT SIZE 48EJ,EK, EW,EY	NOMNAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		OFM			IFM		POWER EXHAUST		COMBUSTION FAN MOTOR	POWER SUPPLY	
		Min	Max	RLA	LRA	RLA	LRA	Qty	Hp	FLA (ea)	Hp	FLA	FLA	LRA	FLA	MCA	MOCP*
048	208/230	187	254	82.1	446	69.2	345	4	1	5.3	20	59.4/ 54.0	—	—	0.96	252.4/247.0	300/300
													23.6	41.6	0.96	276.0/270.6	300/300
											25	74.8/ 68.0	—	—	0.96	267.8/261.0	300/300
													23.6	41.6	0.96	291.4/284.6	300/300
											30	88.0/ 80.0	—	—	0.96	281.0/273.0	300/300
													23.6	41.6	0.96	304.6/296.6	350/300
	460	414	508	42.3	223	28.8	173	4	1	2.7	20	27.0	—	—	0.5	119.5	150
													12.6	23.6	0.5	132.1	150
											25	34.0	—	—	0.5	126.5	150
													12.6	23.6	0.5	139.1	175
											30	40.0	—	—	0.5	132.5	150
													12.6	23.6	0.5	145.1	175
	575	518	632	34.6	164	26.7	120	4	1	2.4	20	22.0	—	—	0.5	101.6	125
													12.6	23.6	0.5	114.2	125
											25	27.0	—	—	0.5	106.6	125
													12.6	23.6	0.5	119.2	150
											30	32.0	—	—	0.5	111.6	125
													12.6	23.6	0.5	124.2	150
054	208/230	187	254	82.1	446	69.2	345	4	1	5.3	15	46.2/ 42.0	—	—	1.44	239.2/235.0	300/300
													35.4	62.4	1.44	274.6/270.4	350/350
											20	59.4/ 54.0	—	—	1.44	252.4/247.0	300/300
													35.4	62.4	1.44	287.8/282.4	350/350
											25	74.8/ 68.0	—	—	1.44	267.8/261.0	300/300
													35.4	62.4	1.44	303.2/296.4	350/350
	460	414	508	43.6	223	30.8	173	4	1	2.7	15	21.0	—	—	0.75	117.1	150
													18.9	35.4	0.75	136.0	175
											20	27.0	—	—	0.75	123.1	150
													18.9	35.4	0.75	142.0	175
											25	34.0	—	—	0.75	130.1	150
													18.9	35.4	0.75	149.0	175
	575	518	632	34.6	164	26.9	120	4	1	2.4	15	17.0	—	—	0.75	96.8	125
													18.9	35.4	0.75	115.7	150
											20	22.0	—	—	0.75	101.8	125
													18.9	35.4	0.75	120.7	150
											25	27.0	—	—	0.75	106.8	125
													18.9	35.4	0.75	125.7	150
058	208/230	187	254	106.4	506	69.2	345	6	1	5.3	20	59.4/ 54.0	—	—	1.44	293.4/288.0	350/350
													35.4	62.4	1.44	328.8/323.4	400/400
											25	74.6/ 68.0	—	—	1.44	308.6/302.0	400/400
													35.4	62.4	1.44	344.0/337.4	450/400
											30	88.0/ 80.0	—	—	1.44	322.0/314.0	400/400
													35.4	62.4	1.44	357.4/349.4	450/450
	460	414	508	52.6	253	30.8	173	6	1	2.7	20	27.0	—	—	0.75	139.7	175
													18.9	35.4	0.75	158.6	200
											25	34.0	—	—	0.75	146.7	175
													18.9	35.4	0.75	165.6	200
											30	40.0	—	—	0.75	152.7	200
													18.9	35.4	0.75	171.6	200
	575	518	632	40.4	176	26.9	120	6	1	2.4	20	22	—	—	0.75	113.8	150
													18.9	35.4	0.75	132.7	150
											25	27	—	—	0.75	118.8	150
													18.9	35.4	0.75	137.7	175
											30	32	—	—	0.75	123.8	150
													18.9	35.4	0.75	142.7	175

See Legend and Notes on page 42.

Table 8 — Electrical Data — 48EJ,EK,EW,EY Units (cont)

UNIT SIZE 48EJ,EK, EW,EY	NOMNAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		OFM			IFM		POWER EXHAUST		COMBUSTION FAN MOTOR	POWER SUPPLY	
		Min	Max	RLA	LRA	RLA	LRA	Qty	Hp	FLA (ea)	Hp	FLA	FLA	LRA	FLA	MCA	MOCP*
064	208/230	187	254	106.4	506	82.1	446	6	1	5.3	25	74.6/ 68.0	—	—	1.44	321.5/314.9	400/400
													35.4	62.4	1.44	356.9/350.3	450/450
											30	88.0/ 80.0	—	—	1.44	334.9/326.9	400/400
													35.4	62.4	1.44	370.3/362.3	450/450
											40	114.0/ 104.0	—	—	1.44	360.9/350.9	450/450
													35.4	62.4	1.44	396.3/386.3	500/450
	460	414	508	52.6	253	43.6	223	6	1	2.7	25	34.0	—	—	0.75	159.5	200
													18.9	35.4	0.75	178.4	225
											30	40.0	—	—	0.75	165.5	200
													18.9	35.4	0.75	184.4	225
											40	52.0	—	—	0.75	177.5	225
													18.9	35.4	0.75	196.4	225
	575	518	632	40.4	176	34.6	164	6	1	2.4	25	27.0	—	—	0.75	126.5	150
													18.9	35.4	0.75	145.4	175
											30	32.0	—	—	0.75	131.5	150
													18.9	35.4	0.75	150.4	175
											40	41.0	—	—	0.75	140.5	175
													18.9	35.4	0.75	159.4	175
068	208/230	187	254	106.4	506	106.4	506	6	1	5.3	25	74.6/ 68.0	—	—	1.44	345.8/339.2	450/400
													35.4	62.4	1.44	381.2/374.6	450/450
											30	88.0/ 80.0	—	—	1.44	359.2/351.2	450/450
													35.4	62.4	1.44	394.6/386.6	500/450
											40	114.0/ 104.0	—	—	1.44	385.2/375.2	450/450
													35.4	62.4	1.44	420.6/410.6	500/500
	460	414	508	52.6	253	52.6	253	6	1	2.7	25	34.0	—	—	0.75	168.5	200
													18.9	35.4	0.75	187.4	225
											30	40.0	—	—	0.75	174.5	225
													18.9	35.4	0.75	193.4	225
											40	52.0	—	—	0.75	186.5	225
													18.9	35.4	0.75	205.4	250
	575	518	632	40.4	176	40.4	176	6	1	2.4	25	27	—	—	0.75	132.3	150
													18.9	35.4	0.75	151.2	175
											30	32	—	—	0.75	137.3	175
													18.9	35.4	0.75	156.2	175
											40	41	—	—	0.75	146.3	175
													18.9	35.4	0.75	165.2	200

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

*Fuse or HACR circuit breaker per NEC.

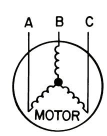
or

NOTES:
1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The Canadian units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent of voltage imbalance.

   % Voltage imbalance

   $$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\text{\% Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

> IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Routing Through Bottom of Unit — If wiring is brought in through bottom of unit, use field-supplied watertight conduit to run power wiring from basepan out through bottom $3^1/_2$-in. hole to the disconnect box and back into unit to the main control box.

Use strain relief going into control box through $2^1/_2$-in. diameter hole provided. After wires are in unit control box, connect to power terminal block (see Power Wiring section on page 33).

Low-voltage wiring must be run in watertight conduit from the basepan to control box and through $^7/_8$-in. diameter hole provided in bottom of unit control box. Field-supplied strain relief must be used going into the box. After wiring is in control box, make connections to proper terminals on terminal blocks (see Field Control Wiring section on this page).

Install conduit connector in unit basepan as shown in Fig. 5-16. Route power and ground lines through connector to terminal connections in unit control box as shown on unit wiring diagram and Fig. 28.

Routing Through Side of Unit — Route power wiring in field-supplied watertight conduit into unit through $2^1/_2$-in. or 3-in. hole. See Fig. 28.

Use field-supplied strain relief going into control box through $2^1/_2$-in. or 3-in. diameter hole provided. After wires are in unit control box, connect to power terminal block (see Power Wiring section on page 33).

Bring low-voltage control wiring through factory-drilled $^7/_8$-in. diameter hole in condenser side post. Use strain relief going into $^7/_8$-in. diameter hole in bottom of unit control box.

After wiring is in control box, make connection to proper terminals on terminal blocks (see Field Control Wiring section below).

IMPORTANT: The VAV (variable air volume) units use variable frequency drives, which generate, use and can radiate radio frequency energy. If units are not installed and used in accordance with these instructions, they may cause radio interference. They have been tested and found to comply with limits of a Class A computing device as defined by FCC (Federal Communications Commission) regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

⚠ WARNING

The unit must be electrically grounded in accordance with local codes and NEC ANSI/NFPA 70 (National Fire Protection Association).

Affix crankcase heater sticker (located in the installers packet) to unit disconnect switch.

Voltage to compressor terminals during compressor operation must be within the voltage range indicated on the unit nameplate. On 3-phase units, phases must be balanced within 2%.

Use the formula in Tables 7 and 8 to determine the percentage of voltage imbalance.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

On 208/230-v units, transformer no. 1 is wired for 230-v. If 208/230-v unit is to be run with 208-v power supply, the transformer must be rewired as follows:

1. Remove cap from red (208 v) wire.
2. Remove cap from spliced orange (230 v) wire. Disconnect orange wire from black unit power wire.
3. Cap orange wire.
4. Splice red wire and black unit power wire. Cap wires.

IMPORTANT: BE CERTAIN UNUSED WIRES ARE CAPPED. Failure to do so may damage the transformers.

FIELD CONTROL WIRING — Install either a Carrier-approved thermostat or a CCN (Carrier Comfort Network) compatible temperature sensor. Thermostats are used on CV (constant volume) units only. Control box diagrams are shown in Fig. 29-31.

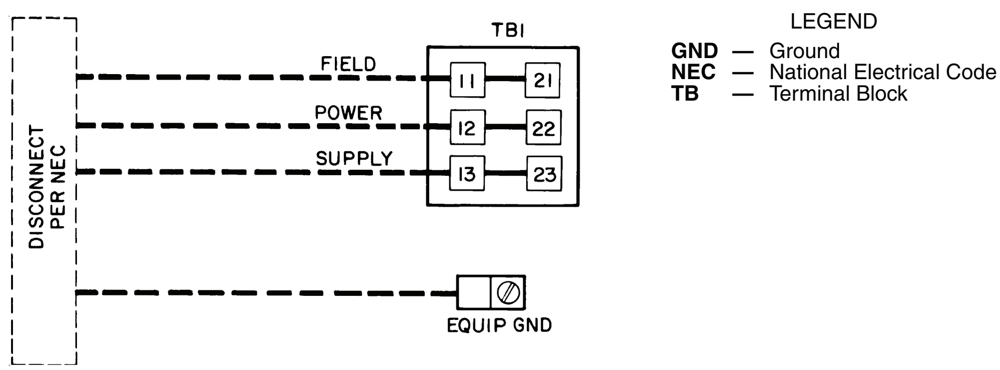
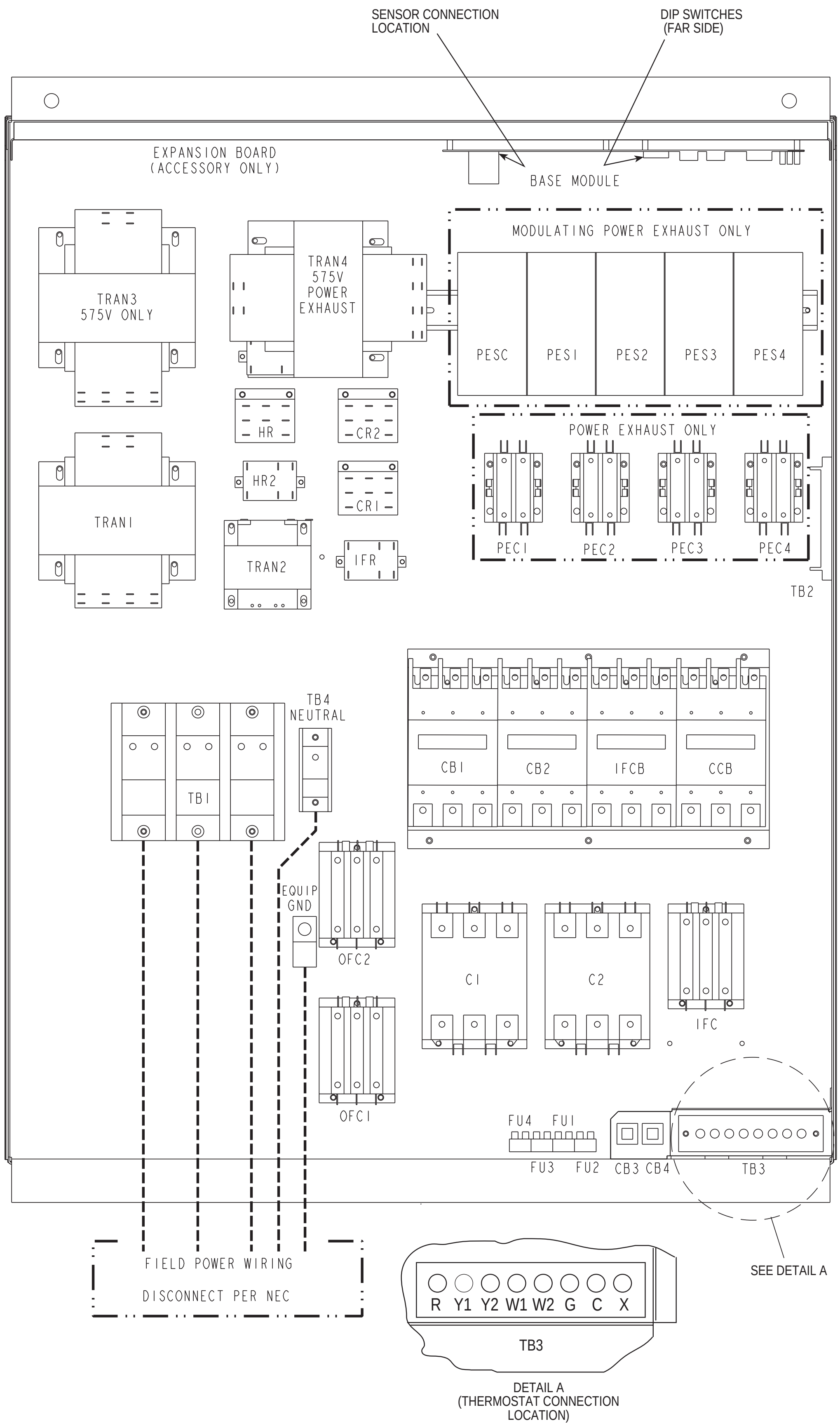


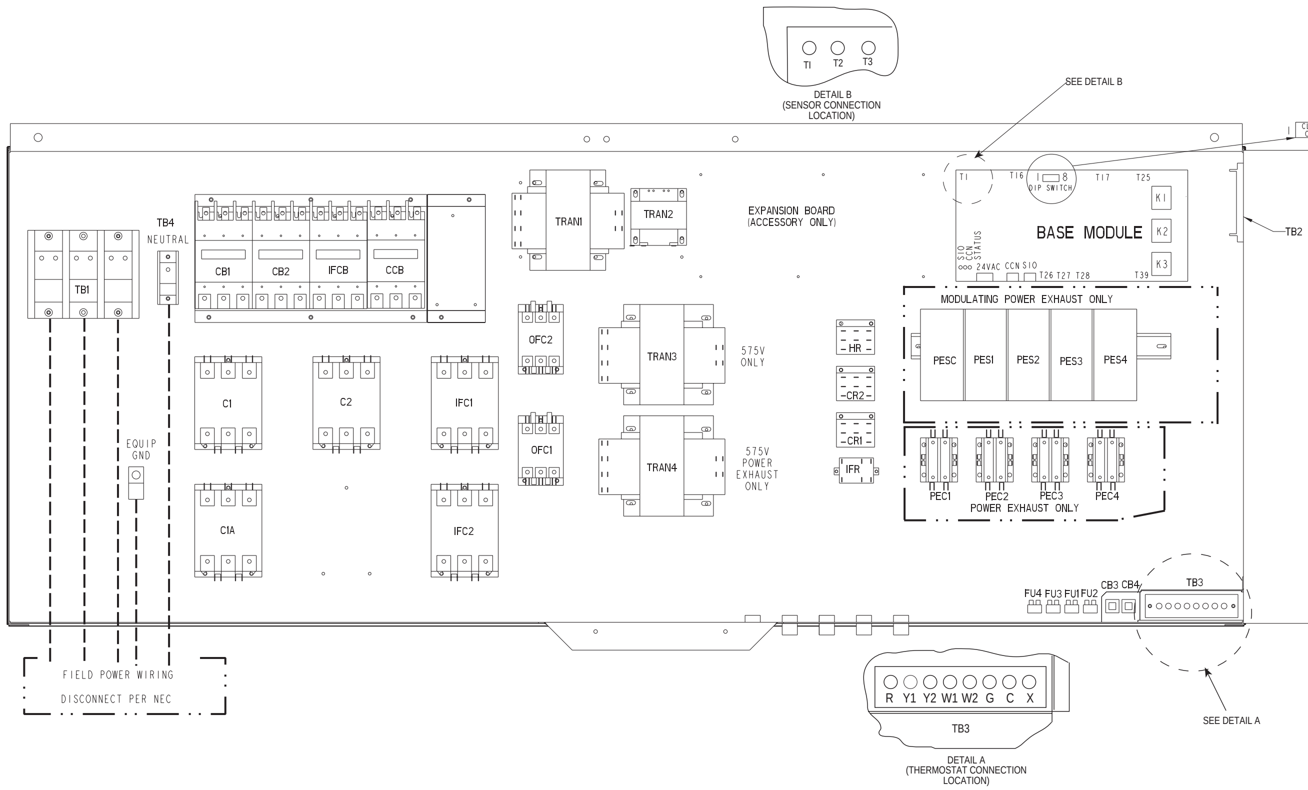
Fig. 28 — Field Power Wiring Connections



LEGEND

- **C** — Compressor/Contactor
- **CB** — Circuit Breaker
- **CCB** — Control Circuit Breaker
- **CR** — Control Relay
- **DIP** — Dual In-Line Package
- **EQUIP** — Equipment
- **FU** — Fuse
- **GND** — Ground
- **HR** — Heater Relay
- **IFC** — Indoor-Fan Circuit
- **IFCB** — Indoor-Fan Circuit Breaker
- **IFR** — Indoor-Fan Relay
- **NEC** — National Electrical Code
- **OFC** — Outdoor-Fan Contactor
- **PEC** — Power Exhaust Controller
- **PES** — Power Exhaust Sequencer
- **PESC** — Power Exhaust Sequencer Controller
- **TB** — Terminal Block
- **TRAN** — Transformer

Fig. 29 — Control Box Diagram (48AJ,AK,AW,AY020-030 and 48EJ,EK,EW,EY024-034 Units)



LEGEND

C — Compressor/Contactor	**FU** — Fuse	**OFC** — Outdoor-Fan Contactor
CB — Circuit Breaker	**GND** — Ground	**PEC** — Power Exhaust Controller
CCB — Control Circuit Breaker	**HR** — Heater Relay	**PES** — Power Exhaust Sequencer
CCN — Carrier Comfort Network	**IFC** — Indoor-Fan Circuit	**PESC** — Power Exhaust Sequencer Controller
CR — Control Relay	**IFCB** — Indoor-Fan Circuit Breaker	**SIO** — Serial Input/Output
DIP — Dual In-Line Package	**IFR** — Indoor-Fan Relay	**TB** — Terminal Block
EQUIP — Equipment	**NEC** — National Electrical Code	**TRAN** — Transformer

Thermostat Wiring (CV Only) — Install a Carrier-approved accessory thermostat assembly (per current price pages) according to the installation instructions included with the accessory or these instructions. Locate the thermostat on a solid interior wall in the conditioned space to sense the average temperature.

Route the thermostat cable or equivalent single leads of colored wire from the subbase terminals to the low-voltage connection as shown on unit label wiring diagram and in Fig. 32.

NOTE: For wire runs up to 50 ft, use no. 18 AWG (American Wire Gage) insulated wire (35 C minimum). For 50 to 75 ft, use no. 16 AWG insulated wire (35 C minimum). For over 75 ft, use no. 14 AWG insulated wire (35 C minimum). All wire larger than no. 18 AWG cannot be directly connected at the thermostat and will require a junction box and splice at the thermostat.

Set heat anticipators to 0.1 for all voltages. Settings may be changed slightly to provide a greater degree of comfort for a particular installation.

Sensor Wiring (CV or VAV) — The temperature sensor is wired into the unit control board. See Fig. 33.

The unit is controlled with a T-55 or T-56 (CV only) zone sensor. Terminal TH (T-56) or T1 (T-55) on the sensor is connected to T1 of the base control board. Terminal COM (T-56) or T2 (T-55) on the sensor is connected to T2 on the base control board. If a T-56 set point override sensor is used, the override connection SW on the sensor is connected to T3 on the base control board.

If more than sensor is being used and averaged, sensors must be wired in multiples of 4 or 9. See Fig. 34.

Heat Interlock Relay — VAV units require a field-supplied heat interlock relay (HIR) to drive the air terminal wide open when in heat mode. Heat Interlock relay part number is HN61KK040. See Fig. 35 for HIR wiring.

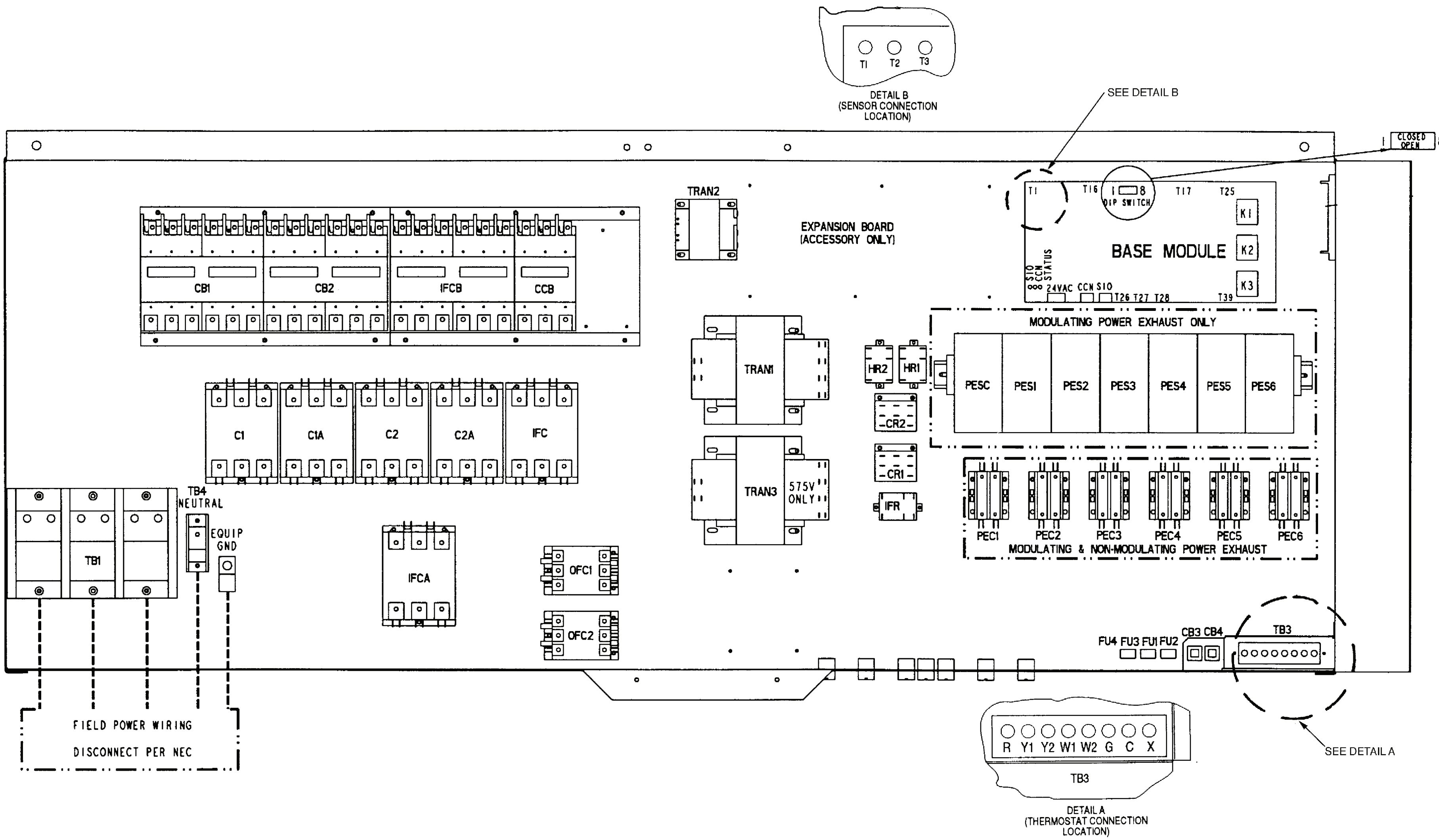
Remote Field Control — A switch closure across terminals R and W1 on TB-3 will initiate the Occupied mode. This can be done manually as well as through a field-supplied timeclock.

Service Tool, Building Supervisor, and ComfortWORKS® Software — Access to the control board can be achieved through the terminal marked CCN via a 3-wire bus.

> IMPORTANT: The default bus address is 0. The default element number is 1. Refer to CCN literature for information on network addressing or changing CCN communication defaults.

Carrier Comfort Network Interface — The rooftop units can be connected to the CCN. The communication bus wiring is supplied and installed in the field. Wiring consists of shielded, 3-conductor cable with drain wire.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it, the negative pins must be wired to the negative pins, and the signal pins must be wired to signal ground pins. Wiring connections for CCN should be made at the 3-pin plug (CCN located at the base board). Consult CCN literature for further information.



LEGEND

C	— Compressor/Contactor	**FU**	— Fuse	**OFC**	— Outdoor-Fan Contactor
CB	— Circuit Breaker	**GND**	— Ground	**PEC**	— Power Exhaust Controller
CCB	— Control Circuit Breaker	**HR**	— Heater Relay	**PES**	— Power Exhaust Sequencer
CCN	— Carrier Comfort Network	**IFC**	— Indoor-Fan Circuit	**PESC**	— Power Exhaust Sequencer Control-ler
CR	— Control Relay	**IFCB**	— Indoor-Fan Circuit Breaker	**SIO**	— Serial Input/Output
DIP	— Dual In-Line Package	**IFR**	— Indoor-Fan Relay	**TB**	— Terminal Block
EQUIP	— Equipment	**NEC**	— National Electrical Code	**TRAN**	— Transformer

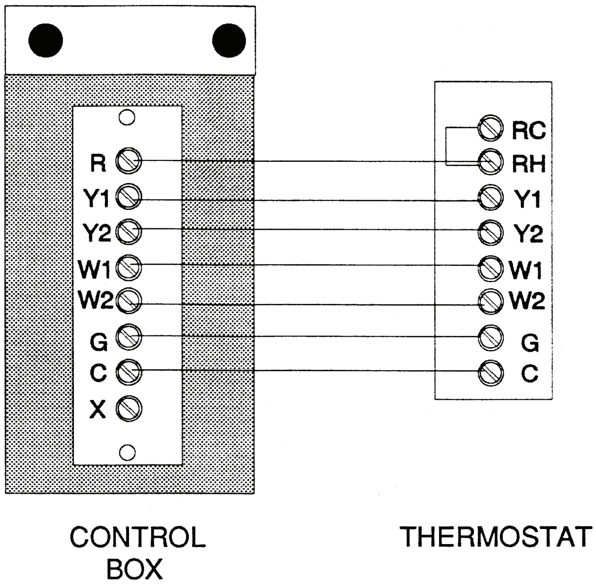
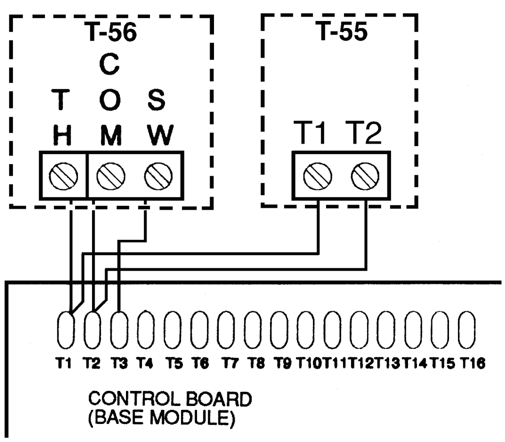


Fig. 32 — Field Control Thermostat Wiring



NOTE: Sensor part numbers are as follows:

T-55 — CEC0121448-01
T-56 — CEC0121448-01

Fig. 33 — Field Control Temperature Sensor Wiring (CV or VAV Units)

Conductors and drain wire must be 20 AWG minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -20 C to 60 C (-4 F to 140 F) is required. Table 9 lists cables that meet the requirements.

Table 9 — CCN Connection Approved Shielded Cables

MANUFACTURER	CABLE PART NO.
Alpha	2413 or 5463
American	A22503
Belden	8772
Columbia	02525

IMPORTANT: When connecting the CCN communication bus to a system element, use a color coding system for the entire network to simplify installation and checkout. See Table 10.

Table 10 — Color Code Recommendations

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR	CCN PLUG PIN NO.
Positive (+)	RED	1
Ground	WHITE	2
Negative (-)	BLACK	3

NOTE: If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network.

At each system element, the shields of the communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to a ground **at one point only**. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only).

To connect the unit to the network:

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground), and black (-) conductors. (If a different network color scheme is used, substitute appropriate colors.)
3. Remove the 3-pin male plug from the base control board in the main control box, and connect the wires as follows:
   a. Insert and secure the red (+) wire to terminal 1 of the 3-pin plug.
   b. Insert and secure the white (ground) wire to terminal 2 of the 3-pin plug.
   c. Insert and secure the black (-) wire to terminal 3 of the 3-pin plug.
4. Insert the plug into the existing 3-pin mating connector on the base module in the main control box.

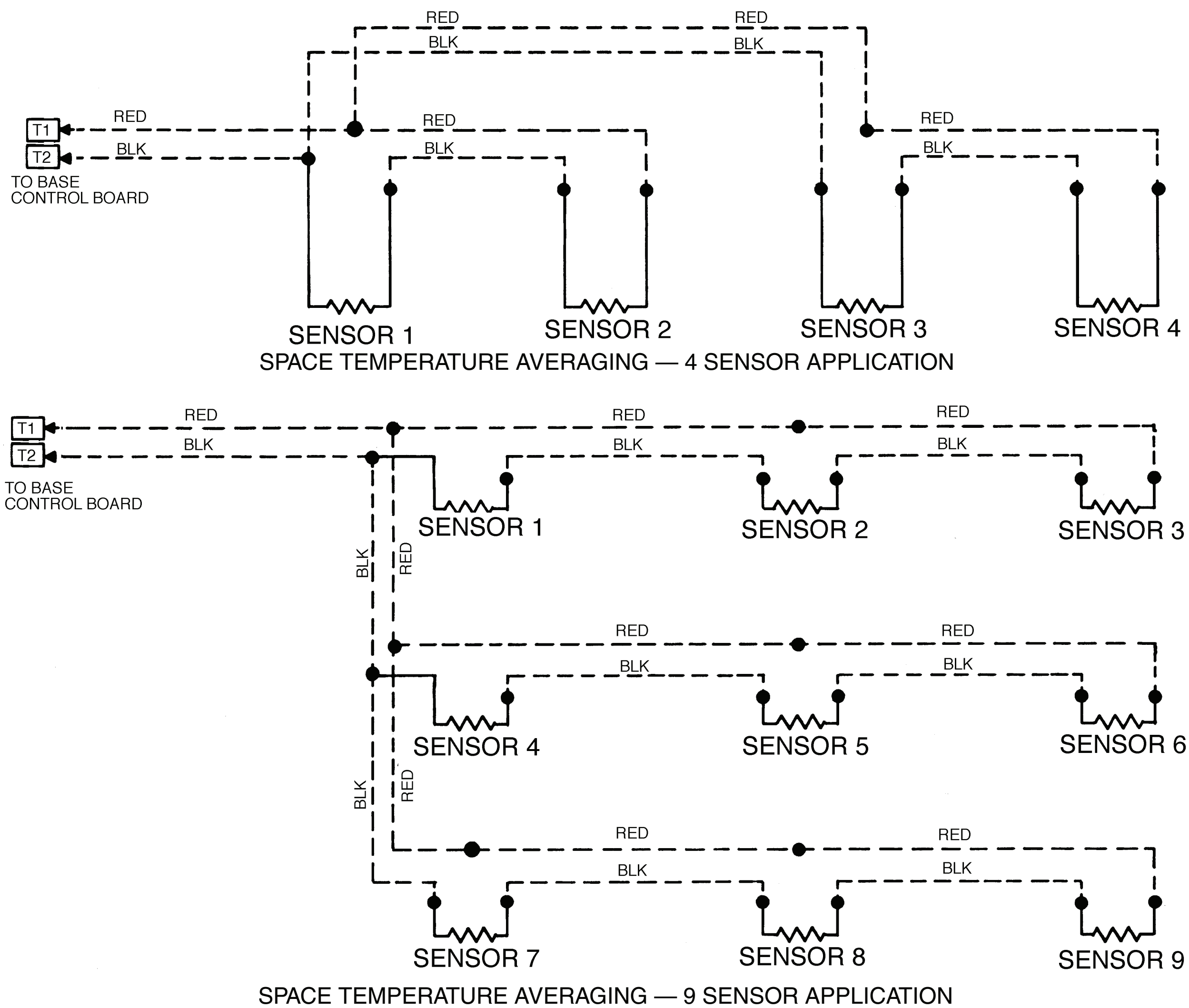


Fig. 34 — Space Temperature Averaging Wiring

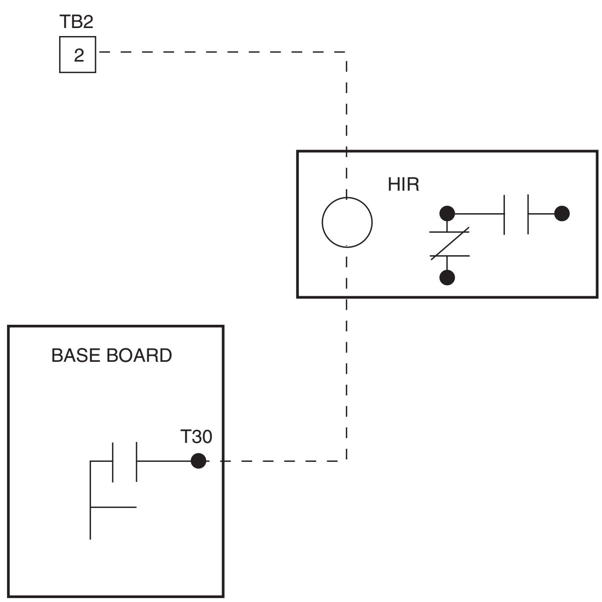


Fig. 35 — Field HIR (Heat Interlock Relay) Wiring

Step 10 — Make Outdoor-Air Inlet Adjustments

ECONOMIZER

NOTE: If accessory power exhaust or barometric relief packages are being added to the unit, install power exhaust or barometric relief before installing economizer hoods.

Economizer Hood Assembly — The economizer hood is shipped in a package secured to the outside of the unit, behind the indoor access panel. The hood assemblies must be field-assembled. The 48AW,AY and 48EW,EY units are side supply and side return. The return duct limits access to economizer filters from below. Filter tracks (mounting angle without tabs) must be installed correctly to allow access to economizer filters from each side.

The 48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048 units have two hoods on every unit. Each hood has two lower filter tracks, one slotted side and one side without slots. Construct the assembly so that the slotted side is adjacent to the other hood when mounted on the unit.

The 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 units have 3 hoods on every unit. Each hood has two lower filter tracks, one slotted side and one side without slots. Construct the two outer hood assemblies so that the slotted sides are adjacent to the center hood when mounted on the unit.

NOTE: Before assembly of the economizer hood, check along the outer edges of the economizer assembly for any seal strip protruding past the flanges. Trim the excess seal strip so that it is flush with the economizer assembly flanges.

Perform the following procedure to assemble the economizer hood.

1. Apply black seal strip (provided in package) to outside top-edge of hood sides. Wrap seal strip over edge to cover top flange (6 hood sides). Make sure seal strip covers screw holes. Allow strip to overhang $^{1}/_{8}$-in. past the end opposite the mounting flange. See Fig. 36.
2. Assemble hood sides, top, and cross member with gasketed screws provided. See Fig. 37.
3. Attach 15 green speed clips (provided) to hood top.
4. Apply black seal strip (provided) to mounting flanges of hood sides being sure to cover mounting holes. See Fig. 38.

NOTE: Each hood assembly has one hood side with slots and one hood side without slots. On the 48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048 units, the two outer hood assemblies must have the hood sides with the slots located adjacent to each other when mounted on the unit. On the 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 units, the two outer hood assemblies must have the hood sides with the slots located adjacent to the center hood. The center hood assembly should have hood side with slots located on the left side.

5. Apply black seal strip (provided) to back of hood top mounting flange. Seal strip of hood top mounting flange must press tightly against seal strip of hood side mounting flanges. See Fig. 39.
6. Add gray foam strip (provided in package) to cross members on bottom tray. See Fig. 40.
7. Place gray foam strip (provided) on inside of slotted hood side between filter and cross member opposite the mounting end. See Fig. 41.
8. Attach gray foam strip (provided) to block-off baffle on outer face of flange. See Fig. 42.
9. Remove the screws on each end and along top of damper assembly of unit. Remove top 4 screws on each side of filter panel under damper assembly. Set hood assembly in place and attach to unit using these screws.
10. Attach the outside-air thermostat (OAT) that is supplied from the factory or accessory field-supplied enthalpy sensor onto the hood side furthest from the control box. The OAT or enthalpy sensor is installed on the inside upper right-hand corner using the mounting bracket and mounting holes provided. Attach wiring to unit controls. If accessory enthalpy sensor is used, quick connects must be attached to enthalpy sensor wires.
11. Remove screws along bottom of damper assembly. Locate and mount blockoff baffle using these screws.
12. Assemble 2 filter tracks side-by-side with the assembled ends together.
13. Attach mounting angle (without tabs) to the assembled end of the filter track. See Fig. 43.
14. Attach 9 green speed clips (provided) to hood side panels without slots. Engagement section of clip faces up and towards the outside of the hood side panels.
15. Attach remaining mounting angle (with tabs) to other end of the filter track with no. 10 screws provided. See Fig. 44.
16. Place filter track assembly in bottom of hood by placing tabbed end into slotted side (with tab on bottom) and attaching opposite end to hood with speed clips and gasketed screws provided. Tabs can be hand bent after they have been inserted into the side.

NOTE: The filter track assembly end with screws should face away from the other hood when mounted on the unit. Be sure the filters are installed with the airflow in the correct direction.

NOTE: Tabs from both filter tracks will be in the same space. After one filter track has been inserted into hood side, bend the tabs so they will not interfere with installation of the second/ center hood.

17. Attach black seal strip (provided) to filter cover. Seal strip should be applied centered over the holes of the one flange, making sure to fully cover holes and centered over the other large flange. See Fig. 45.
18. Slide two 20 x 25-in. filters into cross members of hood assembly. Attach filter cover over filters with screws and speed clips provided.

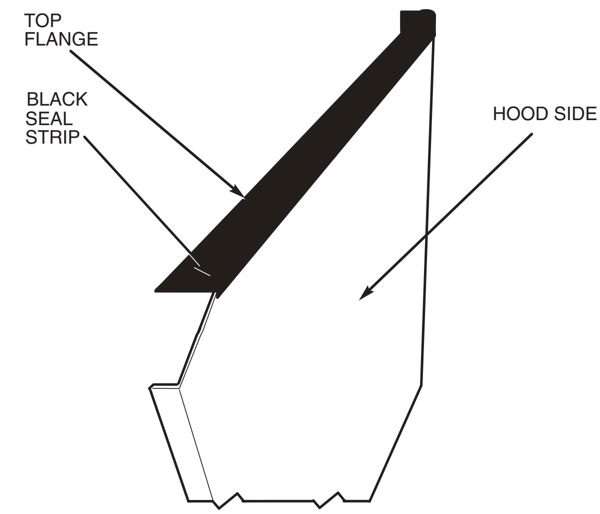
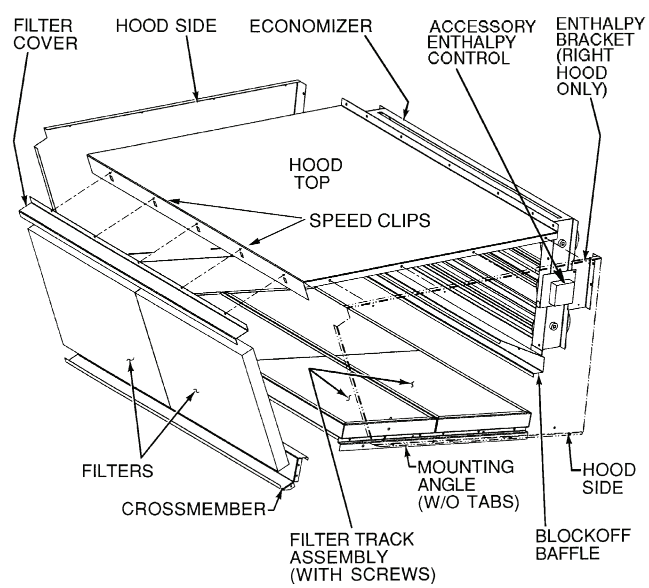


Fig. 36 — Adding Seal Strip to Top of Hood Sides



NOTE: Left side economizer hood has mounting angle without tabs and filter rack assembled end on the opposite side.

Fig. 37 — Economizer Hood Assembly (Right Side/Center Economizer Hood Shown)

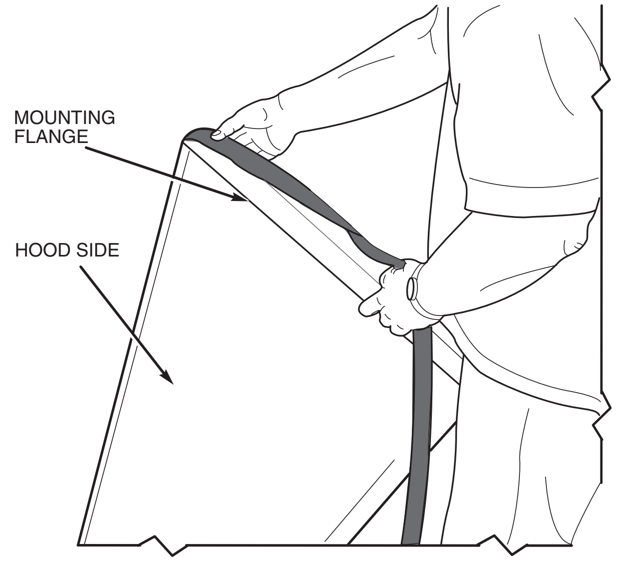


Fig. 38 — Adding Seal Strip to Sides of Hood Top Mounting Flange

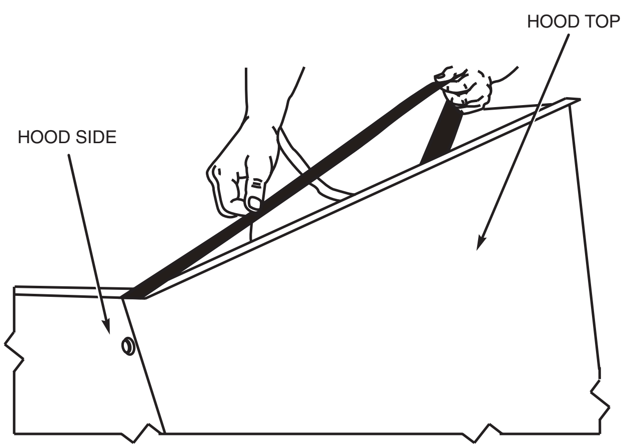


Fig. 39 — Adding Seal Strip to Back of Hood Top Mounting Flange

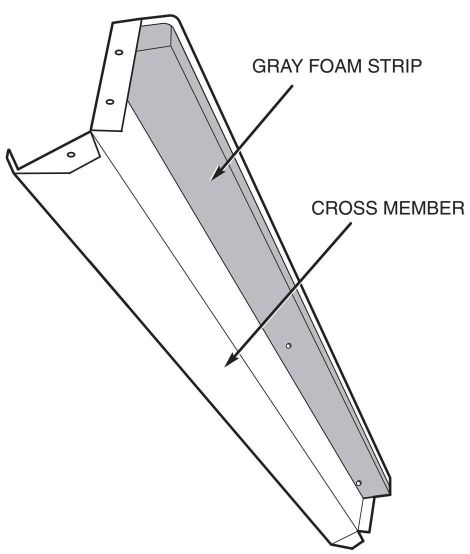


Fig. 40 — Adding Foam Strip to Cross Member

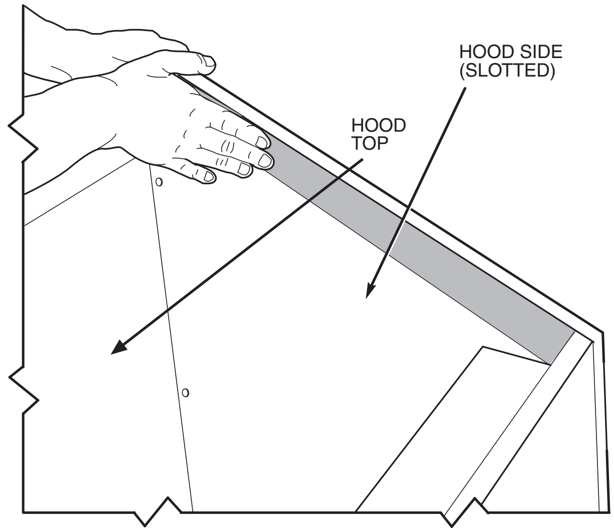


Fig. 41 — Adding Foam Strip to Hood Side

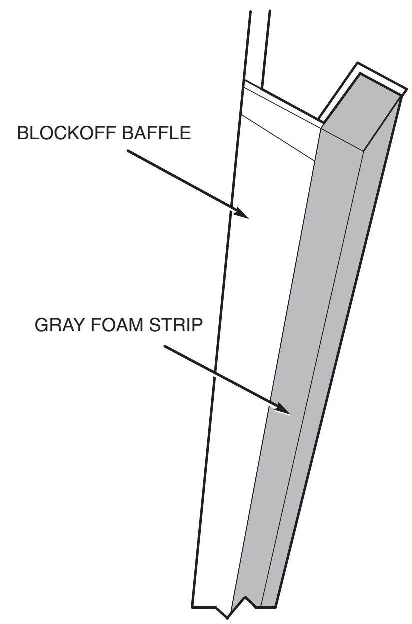


Fig. 42 — Adding Seal Strip to Blockoff Baffle

Minimum Damper Position (MDP) Setting — Setting of the outdoor air damper position is performed in conjunction with a shortened version of the field run test. This is performed by first opening DIP (Dual In-line Package) switch no. 4 then no. 6. See Fig. 27 and Direct Digital Controls DIP Switch Configuration section on page 63.

The outdoor-air damper closes. The control allows 90 seconds for the damper to close in case it is in the full open position. Next, the indoor-fan contactor will energize. The outdoor-air damper will remain at 0% for 30 seconds. It will then move to the 10% damper motor travel position for another 30 seconds. This will be repeated at every 10% increment for 30 seconds until the damper reaches 100% open. Close DIP switch no. 4 during the 30 seconds immediately after the desired outdoor air minimum damper position. The 30-second time period is to allow time where DIP switch no. 4 can be closed. The default value of the minimum outdoor air damper position is 20%. If the desired minimum position is 30%, allows the damper position to go to 10% for 30 seconds, then 20% for 30 seconds, and when it reaches 30% close DIP switch no. 4 during the 30-second period following the 30% position.

The minimum outdoor air damper position is now set. Close DIP switch no. 6.

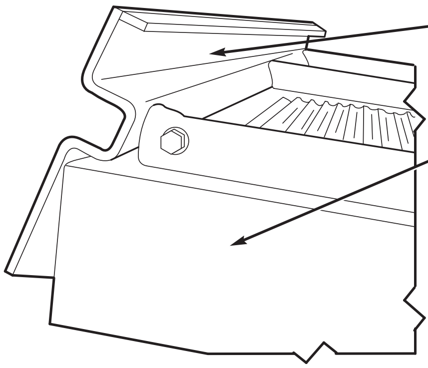


Fig. 43 — Mounting Angle (Without Tabs) Attached to Filter Track Assembly

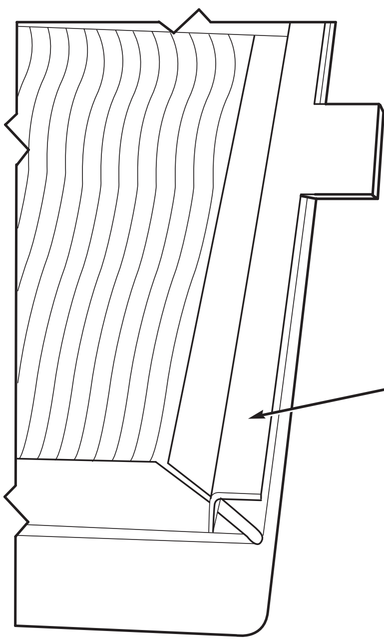


Fig. 44 — Mounting Angle (With Tabs) Attached to Filter Track Assembly

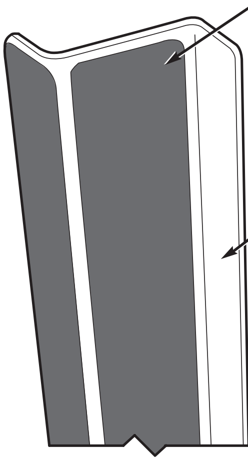


Fig. 45 — Attaching Seal Strip to Filter Cover

ECONOMIZER SETTINGS

Accessory Enthalpy Control (Fig. 46) — The control (HH57AC077) is mounted in the economizer hood. See Fig. 37. The enthalpy setting adjustment is on the enthalpy control. For maximum benefit of outdoor air, set enthalpy control to A. See Fig. 47 and 48.

The enthalpy controls operation of the economizer outdoor-air damper to provide free cooling on a signal form the cooling thermostat.

Enthalpy Control Installation — The outdoor air enthalpy control is installed on the inside panel of the outdoor air hood. The enthalpy control should be mounted when the outdoor air hoods are assembled. To install the control, perform the following procedure:

1. Turn off all power. Ensure disconnect is locked out.
2. Remove the economizer inlet filters from the bottom of the right hand economizer hood. See Fig. 37. See Fig. 49 for economizer details.
3. Mount the outdoor air enthalpy sensor inside the right economizer hood on the right side panel of the hood, adjacent to the outdoor-air thermistor.
4. Locate the red, violet, and brown wires near the outdoor air thermistor. Remove the splice from the red and violet wires. Remove the cap from the brown wire.
5. Install a $^1/_4$-in. push on terminal (field-supplied) on the violet and brown wires.
6. Connect a $^1/_4$-in. push on terminal (field-provided) to one end of a 18-gage, 6-in. jumper wire (field-provided). Connect the other end to the red wire and attach a $^1/_4$-in. push on connector (field-provided).
7. Connect the red wire with the jumper to terminal TR1. Connect the jumper to terminal 2. Connect the brown wire to terminal TR. Connect the violet wire to terminal 3. All connections are on the enthalpy control.
8. Replace the economizer filters.
9. Return power to unit.

Accessory Differential Enthalpy Control (Fig. 46) — The control (HH57AC077), in conjunction with the accessory enthalpy sensor (HH57AC078), controls economizer operation according to the differential enthalpy. The control is mounted in the economizer hood. The sensor is mounted in the return duct (48AJ,AK and 48EJ,EK) or return air plenum (48AW,AY and 48EW,EY).

Differential Enthalpy Sensor Installation — To install the control, perform the following procedure:

1. Turn off all power. Ensure disconnect is locked out.
2. Remove the economizer inlet filters from the bottom of the right hand economizer hood. See Fig. 37 and 49.
3. Remove the factory-installed, 620-ohm jumper between terminals SR and + on the enthalpy control located inside the outdoor air hood.
4. Connect the violet wire from the enthalpy sensor kit to the + terminal on the enthalpy control. Connect the blue wire from the enthalpy sensor kit to the SR terminal on the enthalpy control.
5. Turn the enthalpy control set point potentiometer clockwise past the “D” setting on the enthalpy control to configure the control to operate on differential enthalpy. See Fig. 47.
6. Remove the return-air enthalpy sensor from the accessory package. Using the screws provided, mount the sensor inside the return duct near the unit. Do not locate the control too far from the unit, or the wires will not reach from the sensor to the control. On 48AW,AY and 48EW,EY units, the enthalpy sensor can be installed in the return air section of the unit, under the return air dampers.

7. Route the wires from the enthalpy sensor to the return air enthalpy control through the holes on the inside of the hinged filter access panel. The holes are blocked by plug buttons which should be removed.
8. Use field-supplied wire ties to attach the violet wire to the + terminal and the blue wire to the SR terminal.
9. Replace economizer filters.
10. Return power to unit.

Disable Economizer — For applications where the economizer will not be used (areas of high humidity), the economizer should be disabled. To disable the economizer, perform the following:

1. Turn of power. Ensure disconnect is locked out.
2. Locate the OAT (Outdoor Air Thermostat) in the right hand outdoor air damper area.
3. Locate the splice connecting the violet wire coming from T24 on the base control board to the red wire coming from T29 on the base control board. Remove the wire nut and break the red to violet wire splice.

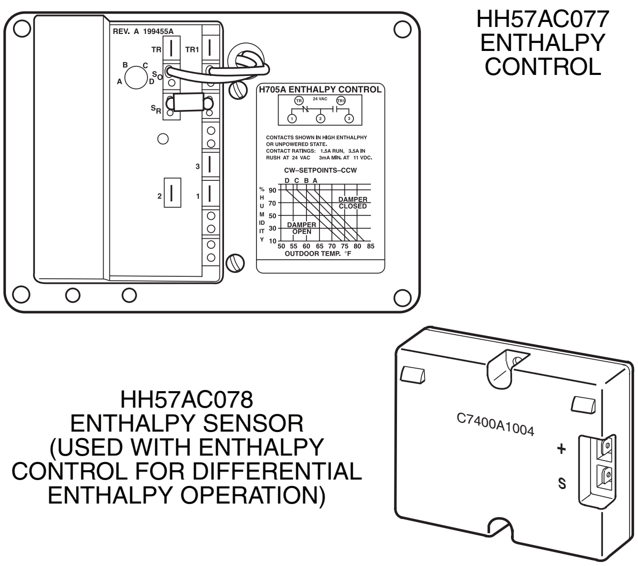
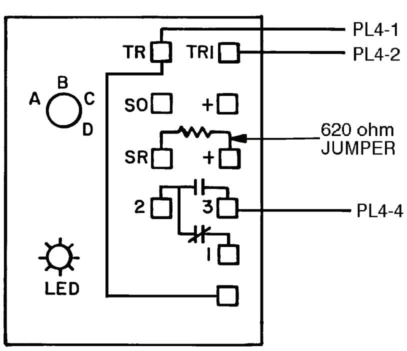


Fig. 46 — Differential Enthalpy Control and Sensor



NOTE: Switches shown in high enthalpy state. Terminals 2 and 3 close on enthalpy decrease.

Fig. 47 — Wiring Connections for Solid-State Enthalpy Control (HH57AC077)

4. Cap off both wires. When the connection is broken the base control board is fooled into thinking that the enthalpy is not acceptable and economizer operation is disabled.
5. Return power to unit.

   NOTE: When the economizer is disabled, the damper will function as a 2-position damper.

Step 11 — Position Power Exhaust/Barometric Relief Damper Hood — All electrical connections have been made and adjusted at the factory. The power exhaust blowers and barometric relief dampers are shipped assembled and tilted back into the unit for shipping. Brackets and extra screws are shipped in shrink wrap around the dampers. If ordered, each unit will have 4 (48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048 units) or 6 (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 units) power exhaust blowers and motors or 4 (48AJ,AK,AW,AY020-050 and 48EJ,EK,EW, EY024-048 units) or 6 (48AJ,AK,AW,AY060 and 48EJ,EK, EW,EY054-068 units) barometric relief dampers.

1. Remove 9 screws holding each damper assembly in place. See Fig. 50. Each damper assembly is secured with 3 screws on each side and 3 screws along the bottom. **Save screws.**

⚠ CAUTION

Be careful when tilting blower assembly. Hoods and blowers are heavy and can cause injury if dropped.

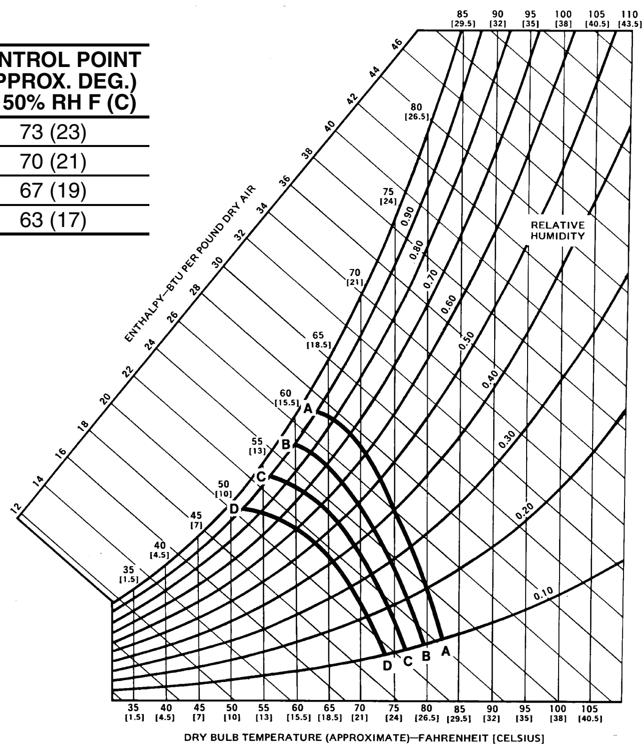
2. Pivot each damper assembly outward until edges of damper assembly rest against inside wall of unit.
3. Secure each damper assembly to unit with 6 screws across top (3 screws provided) and bottom (3 screws from Step 1) of damper.
4. With screws saved from Step 1, install brackets on each side of damper assembly.
5. Remove tape from damper blades.

VAV DUCT PRESSURE TRANSDUCER — The VAV duct pressure transducer (VAV inverter pressure transducer) is located behind the filter access door on the lower inner panel. See Fig. 51. A section of field-supplied $^{1}/_{4}$-in. plastic tubing must be run from the high pressure tap on the differential pressure switch and connected to a field-supplied tap in the supply-air duct. The tap is usually located $^{2}/_{3}$ of the way out on the main supply duct. Remove plug button in panel to route tubing.

VAV BUILDING PRESSURE TRANSDUCER — The VAV building pressure transducer (modulating power exhaust pressure transducer) is located behind the filter access door on the lower inner panel. See Fig. 51. A section of field-supplied $^{1}/_{4}$-in. plastic tubing must be run from the high pressure tap on the differential pressure switch to the conditioned space. The pressure tube must be terminated in the conditioned space where a constant pressure is required. This location is usually in an entrance lobby so that the building exterior doors will open and close properly. Remove plug button in panel to route tubing.

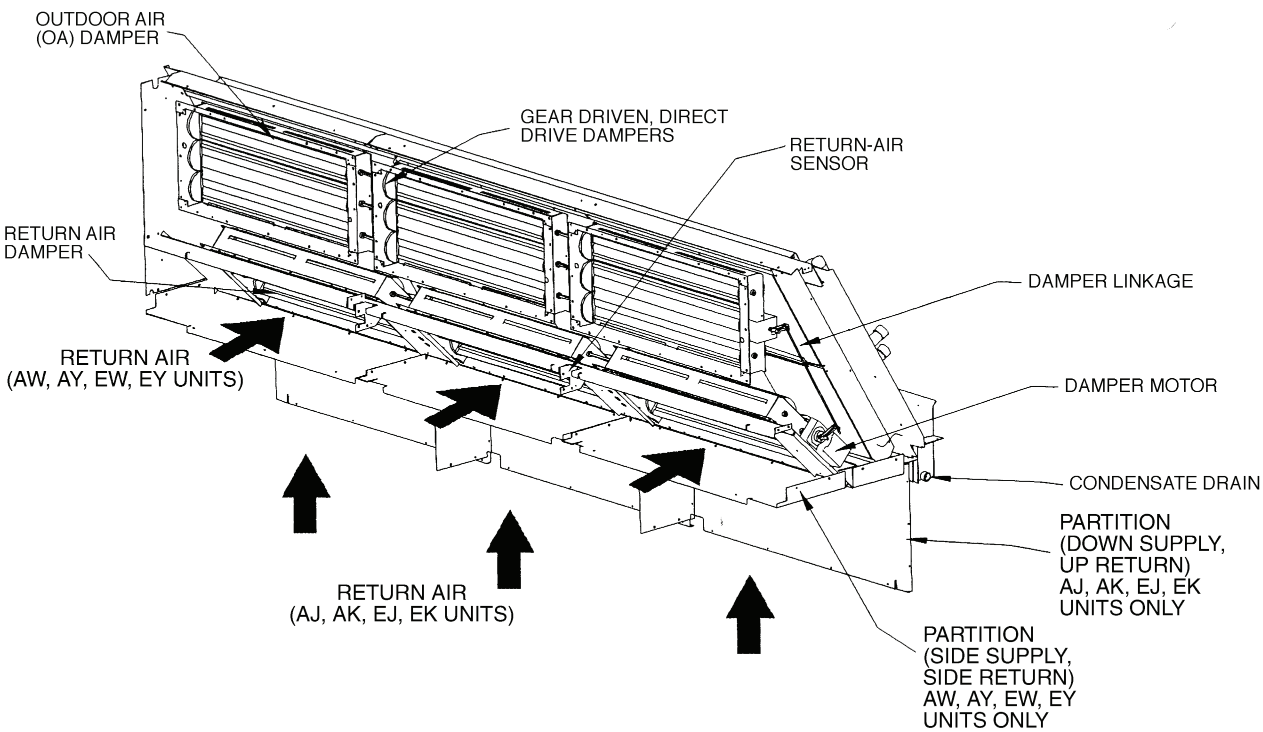
The low pressure tap is factory-routed to the atmosphere. For a positive-pressure building, route the high tap to building air and low tap to atmosphere. For a negative-pressure building, route the high tap to atmosphere and the low tap to building air.

CONTROL CURVE	CONTROL POINT (APPROX. DEG.) AT 50% RH F (C)
A	73 (23)
B	70 (21)
C	67 (19)
D	63 (17)



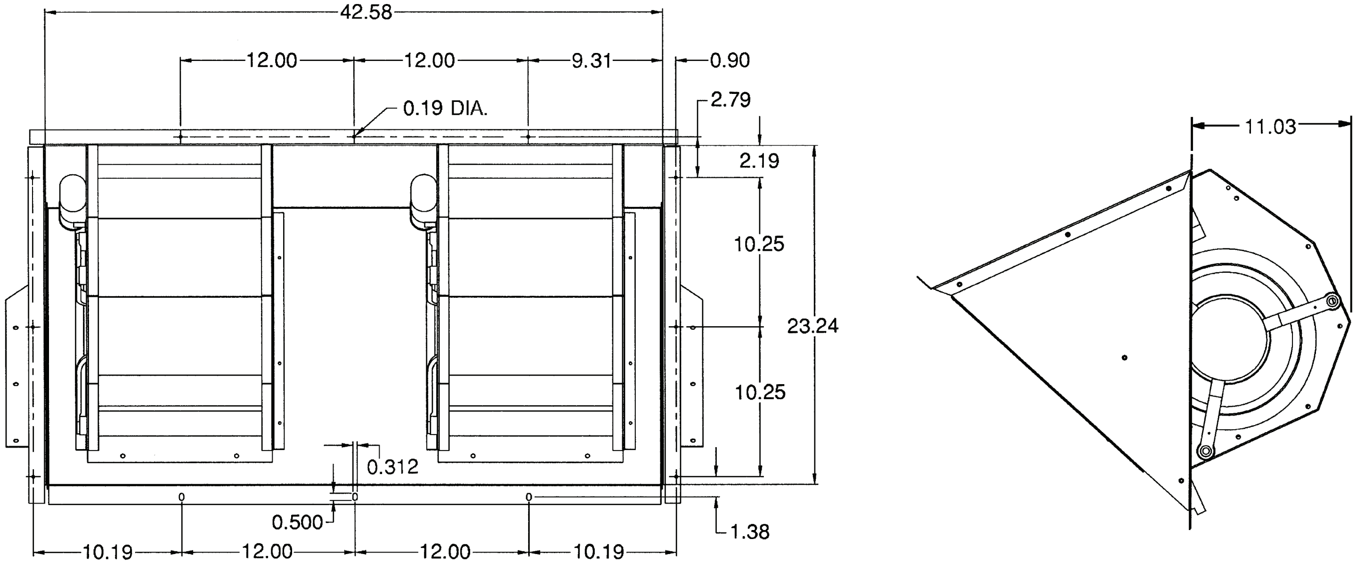
LEGEND
RH — Relative Humidity

Fig. 48 — Psychrometric Chart for Enthalpy Control



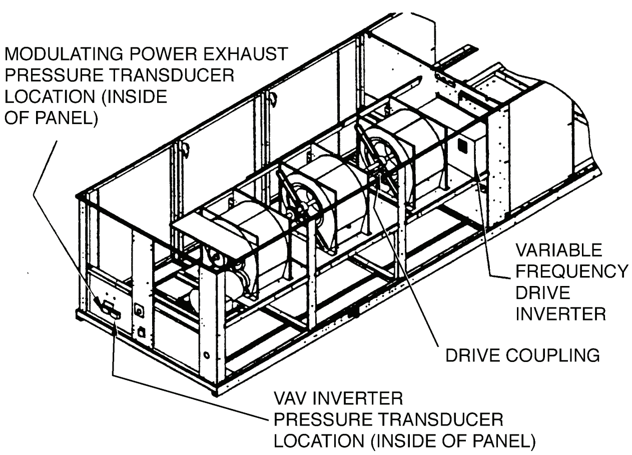
NOTE: Partitions shown indicate both side supply (AW,AY,EW,EY) and vertical supply (AJ,AK,EJ,EK) units.

Fig. 49 — Economizer Details



NOTES:
1. Unless otherwise specified, all dimensions are to outside of part.
2. Dimensions are in inches.
3. On 48AW,AY and 48EW,EY units, accessory barometric relief or power exhaust must be mounted in the field-supplied return ductwork.

Fig. 50 — Barometric Relief Damper and Power Exhaust Mounting Details



LEGEND

VAV — Variable Air Volume

Fig. 51 — Pressure Transducer Locations (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068)

Step 12 — Install All Accessories — After all the factory-installed options have been adjusted, install all field-installed accessories. Refer to the accessory installation instructions included with each accessory.

MOTORMASTER® III CONTROL INSTALLATION

Install Field-Fabricated Wind Baffles — Wind baffles must be field-fabricated for all units to ensure proper cooling cycle operation at low-ambient temperatures. See Fig. 52 for baffle details. Use 20-gage, galvanized sheet metal, or similar corrosion-resistant metal for baffles. Use field-supplied screws to attach baffles to unit. Screws should be $^{1}/_{4}$-in. diameter and $^{5}/_{8}$-in. long. Holes for wind baffles are pre-punched in the unit sheet metal.

⚠ CAUTION

To avoid damage to the refrigerant coils and electrical components, use recommended screw sizes only.

The wind baffles attach to flanges formed on the outer sheet metal of the unit corner post. The other end of the baffle is attached to the center panel between the condenser coil and the indoor section. Two baffles are required.

Install Motormaster® III Controls — Only one Motormaster III control is required per unit.

Motor — One outdoor-fan motor (OFM) must be changed out in the field to accommodate the Motormaster III accessory. The replacement motor part no. is HD52AK652.

For 48AJ,AK,AW,AY020-030 and 48EJ,EK,EW,EY024-034 units, the Motormaster controlled OFM is the no. 2 OFM and is located at the left side of the unit looking from the compressor end. The no. 1 OFM is controlled to shut off at 55 F and on at 65 F outdoor-air temperature and does NOT need to be changed out.

For 48AJ,AK,AW,AY035-050 and 48EJ,EK,EW,EY038-054 units, the Motormaster controlled OFM is no. 1 OFM and is located at the left side of the unit looking from the compressor end and the second motor back. The no. 3 and 4 OFM are controlled to shut off at 55 F and on at 65 F outdoor-air temperature and do NOT need to be changed out. The no. 2 OFM is intended to run at all ambient temperatures.

For 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY058-068 units, the Motormaster controlled OFM is no. 3 OFM and is located at the left side of the unit looking from the compressor end and the second motor back.

The no. 4, 5, and 6 OFMs are controlled to shut off at 55 F and on at 65 F outdoor-air temperature and do NOT need to be changed out. The no. 1 and 2 OFMs are intended to run at all ambient temperatures.

Sensor — Install the sensor for thermistor input control in the location shown in Fig. 53A-53E. Connect sensor leads to the violet and gray control signal leads on the Motormaster III control.

Signal Selection Switch — Remove the cover of the Motormaster III control. Set the switch to accept the thermistor sensor input signal. Set the frequency to match the unit power supply (60 Hz).

Motormaster III Control — The recommended mounting location is in the indoor fan section, mounted on the panel that separates the indoor and outdoor sections. On VAV units, this location is next to the VFD (variable frequency drive).

Do not route the Motormaster III control wiring next to the VFD on VAV units. Use a separate connector through the partition when wiring to the OFM.

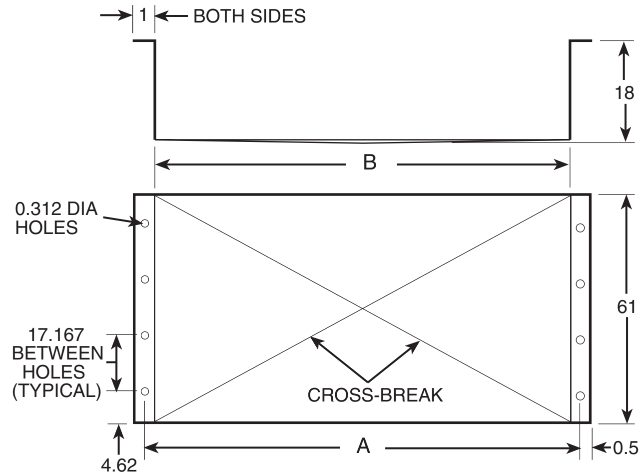
Electrical Connections

⚠ WARNING

To avoid possibility of electrical shock and personal injury, turn off all power to unit before making electrical connections.

When replacing the OFM, reconnect the black, yellow, and blue wires form the outdoor fan contactor to the black, yellow, and blue wires of the Motormaster III control. Run new wires from the red, orange, and brown wires to the leads of the new OFM. Connect the green wire from the control to ground.

NOTE: On all 575-v units, 2 transformers (part no. HT01AH851) must be used for each Motormaster III control to lower the supply voltage to the control to 460-v. Transformers can be mounted anywhere outside the control box.



UNIT SIZE	A	B
48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-054	80.5	79.5
48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY058-068	120.5	119.5

NOTE: All dimensions are in inches. Material: 20 gage galvanized steel or other non-corrosive material.

Fig. 52 — Motormaster III Control Baffle Details

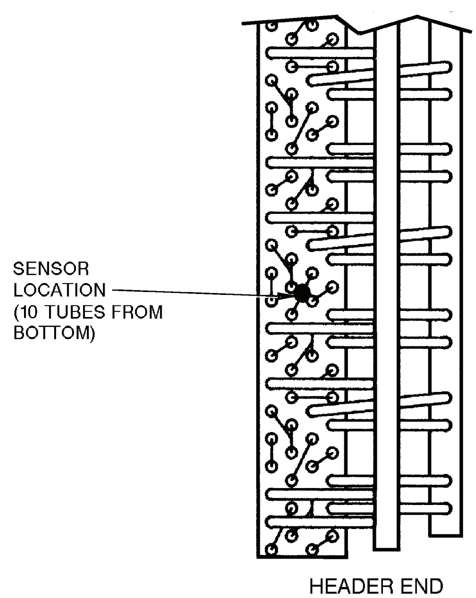


Fig. 53A — Motormaster III Sensor Location (48AJ,AK,AW,AY020-030 and 48EJ,EK,EW,EY024-034)

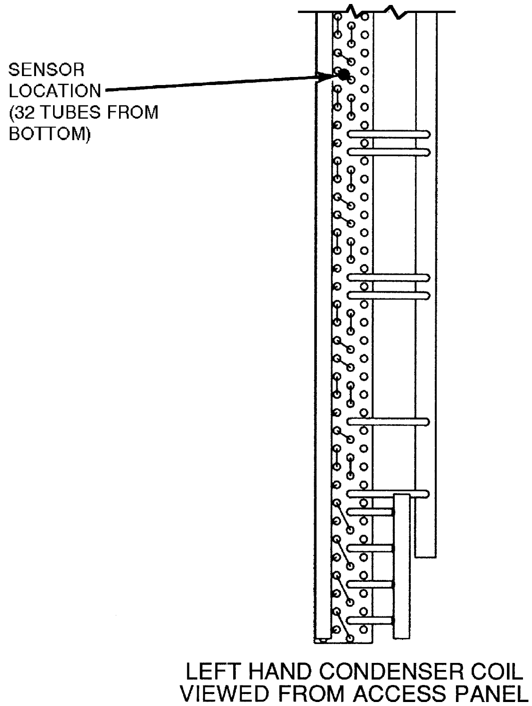


Fig. 53B — Motormaster® III Sensor Location (48AJ,AK,AW,AY035 and 48EJ,EK,EW,EY038, 044)

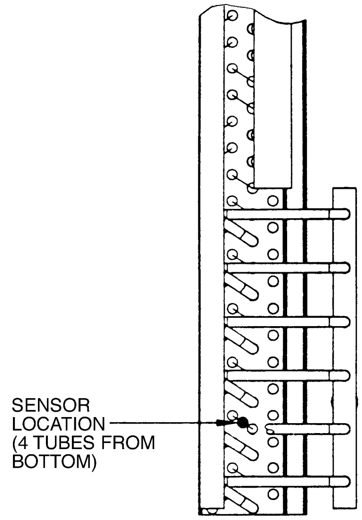


Fig. 53D — Motormaster III Sensor Location (48EJ,EK,EW,EY054-064)

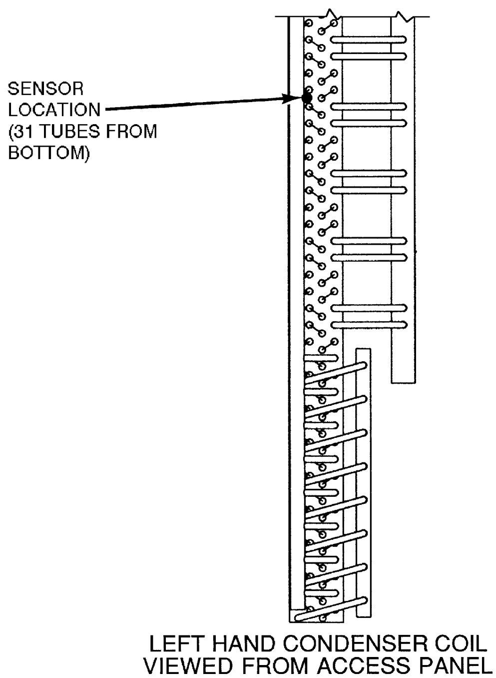


Fig. 53C — Motormaster III Sensor Location (48AJ,AK,AW,AY040, 050 and 48EJ,EK,EW,EY048)

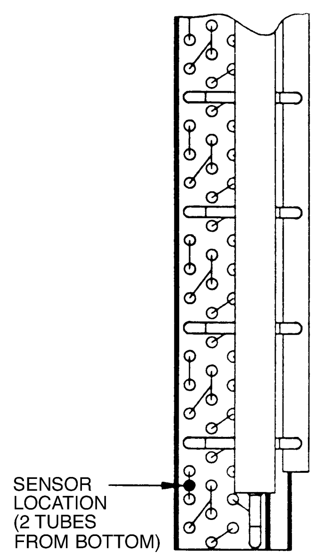


Fig. 53E — Motormaster III Sensor Location (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY068)

Step 13 — Field Modifications

DUCTWORK

Bottom Return Units (48AJ,AK,EJ,EK) Field-Modified for Side Return — 48AJ,AK and 48EJ,EK units with bottom return air connections may be field-modified to accommodate side return air connections.

> IMPORTANT: The following section is a guideline and not a comprehensive procedure to field modify the units. The installing contractor must provide some design initiative. Field-conversion is complex and is not recommended. Units with electric heat must not be converted because of potential heating mode operating problems.

Conversion to horizontal return requires that the bottom return openings of the unit must be sealed with airtight panels capable of supporting the weight of a person. The return ductwork connection locations on the side of the unit are higher than normal (31-in. high). Unit-mounted power exhaust or barometric relief cannot be used because of return air ductwork will cover the power exhaust or barometric relief installation locations. Power exhaust or barometric relief may be installed in the return air ductwork.

To convert the unit, perform the following:

1. Seal the bottom return openings of the unit with airtight panels capable of supporting the weight of a person.
2. Remove the panels located below the economizer outdoor air dampers. These openings will be used for the return air ductwork. There are 2 panels on 48AJ,AK020-050 and 48EJ,EK024-048 units. There are 3 panels on 48AJ,AK060 and 48EJ,EK054-068 units. These openings are normally used for power exhaust or barometric relief.
3. Run the return air ductwork up to the openings. One single duct is recommended to connect to the unit over the return air openings. See Fig. 54. The return duct must incorporate a minimum $^3/_4$-in. flange for connection to the unit cabinet. The unit does not have duct flanges for this conversion.

Side Supply and Return Units (48AW,AY,EW,EY) With Field-Installed Power Exhaust in Return Duct — Space must be available in the return duct to mount the power exhaust fan (gravity relief) modules. Dimensions and suggested locations are shown in Fig. 55. These instructions are a guideline and not a comprehensive procedure. The design contractor must provide some design initiative.

The wiring harness that is provided with the power exhaust accessory is not long enough for the fan modules to be mounted in the return air duct. Field-supplied wiring must be spliced into the harness. Use a junction box at each splice. The wiring may be run in the return duct as shown in Fig. 55, or externally in conduit. A service access panel will be needed near each power exhaust fan.

ELECTRIC UNLOADERS (Constant Volume Units Only) — The rooftop units with version 4.0 control software and later are capable of controlling electronic unloaders when in the constant volume (CV) operating mode. The unloaders may be installed in the field and wired to the control box as shown in Fig. 56.

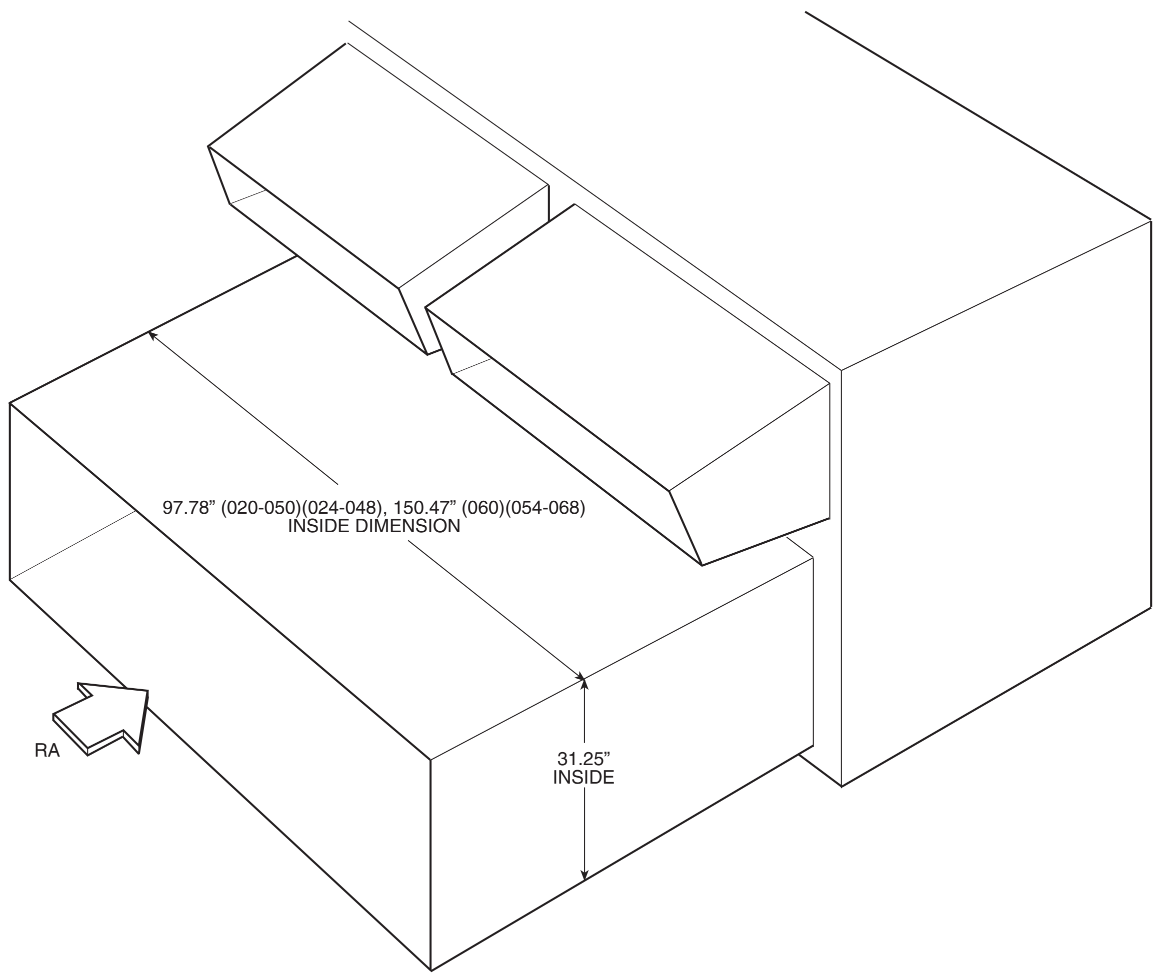


Fig. 54 — Side Return Air Conversion

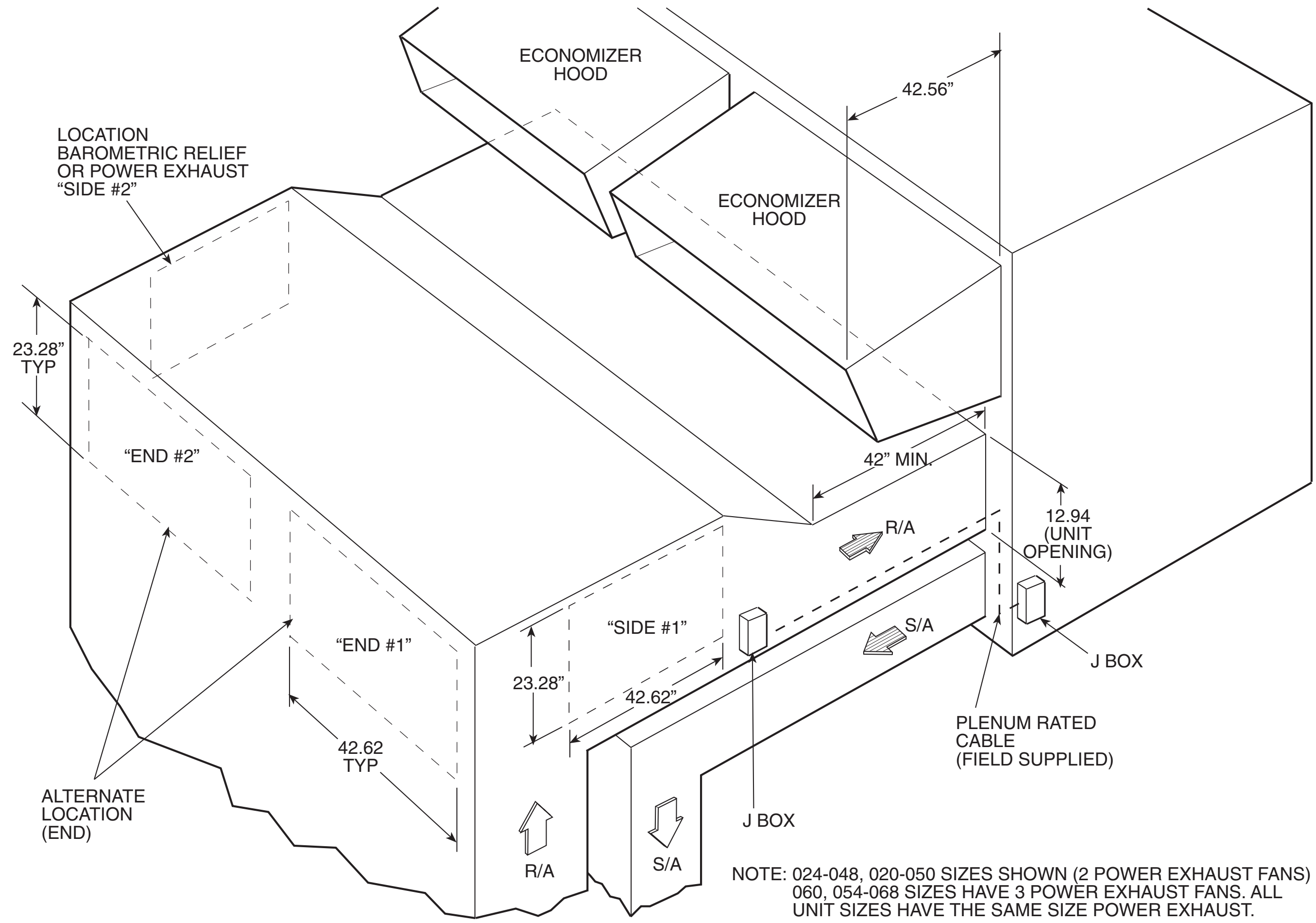


Fig. 55 — Power Exhaust Relocated to Side Return Duct

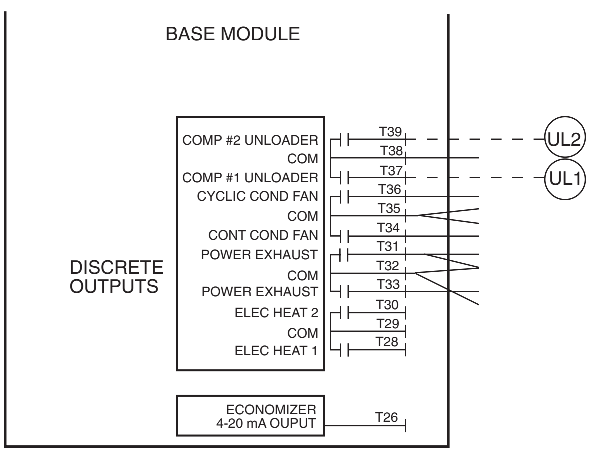


Fig. 56 — Wiring Field-Supplied Unloaders for Constant Volume Units

START-UP

Use the following information and Start-Up Checklist on pages CL-1 and CL-2 to check out unit PRIOR to start-up.

Unit Preparation — Check that unit has been installed in accordance with these installation instructions and applicable codes.

Compressor Mounting — Loosen the compressor hold-down bolts until sidewise movement of the washer under each holddown bolt head can be obtained. Do not loosen completely as bolts are self-locking and will maintain adjustment.

Service Valves — Ensure that the suction, discharge, and liquid line service valves are open. Damage to the compressor could result if they are left closed.

Internal Wiring — Check all electrical connections in unit control boxes; tighten as required.

Refrigerant Service Ports — Each refrigerant system has one suction port located in the top of the compressor motor casing. All units also have one service port on the liquid line valve and one on the compressor discharge valve. Be sure that caps on the ports are tight.

Crankcase Heaters — Crankcase heaters are energized as long as there is power to the unit, except when the compressors are operating.

IMPORTANT: Unit power must be on for 24 hours prior to start-up. Otherwise, damage to compressor may result.

Variable Frequency Drive (VFD) — The variable frequency drives are factory set. These settings include factory-installed jumpers and software configurations. The only field configured set point is duct static pressure. A Toshiba Operation Manual is shipped with each VAV unit. This manual should be used if the drive needs to be customized for a particular application.

NOTE: The VFD will always provide the proper phase sequence to the indoor-fan motor. The indoor-fan motor operates in proper rotation regardless of the phase sequence to the unit. If, upon start-up, the outdoor fans operate backwards but the indoor fan operates in the correct direction, reverse any two leads to the main terminal block. All fans will then operate in the correct direction.

A factory-supplied 2-wire duct pressure transducer is supplied and wired complete with cable ground to reduce electrical noise. A $^1/_4$-in. air pressure tube must be routed to a location in the supply air ductwork where it can sense supply air duct pressure. The recommended location is about $^2/_3$ of the way out on the supply ductwork, so that a steady pressure will be provided for the transducer.

To set the duct static pressure, perform the following steps. The factory setting is zero. The duct transducer has a range from 0 to 5 in. wg. The transducer output is 4 to 20 mA, therefore, 0 to 5 in. wg is proportional to the 4 to 20 mA and must be expressed to the VFD in terms of percentage of the frequency range. Refer to Table 11. The set point value is a percentage of the maximum output frequency. Locate the duct static pressure closest to that desired and use the corresponding set point value. If necessary, interpolation between duct static pressures is permissible.

Table 11 — Toshiba TOSVERT VFD Set Point (Frequency Command) for Supply Duct Pressure

PRESSURE		CONTROL SIGNAL (mA)	VFD SET POINT (Hz)
in. wg	kPa		
0.0	0.000	4.0	0
0.25	0.062	4.8	3
0.50	0.124	5.6	6
0.75	0.187	6.4	9
1.00	0.249	7.2	12
1.25	0.311	8.0	15
1.50	0.373	8.8	18
1.75	0.435	9.6	21
2.00	0.498	10.4	24
2.25	0.560	11.2	27
2.50	0.622	12.0	30
2.75	0.684	12.8	33
3.00	0.747	13.6	36
3.25	0.809	14.4	39
3.50	0.871	15.2	42

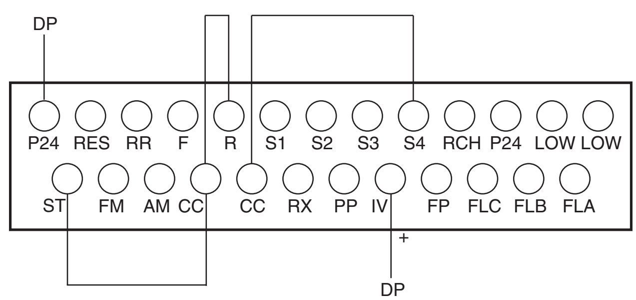
TOSHIBA TOSVERT130-E3 VFD — The VFD must be powered up, however, since it is located near the indoor fan, operation of the fan is not desirable. To disable the fan and set the duct static pressure, perform the following procedure:

1. Open the Indoor Fan Circuit Breaker (IFCB). This will shut off power to the VFD.
2. Wait for the VFD display to go blank and remove VFD cover without touching any interior components. Make sure that the charge indicator lamp is out, indicating that the VFD is discharged. The lamp is located on the upper right hand corner of the terminal block. It may take several minutes for the VFD to fully discharge.

⚠ WARNING

A high voltage potential can exist with the indoor fan circuit breaker open. The charge LED, located in the top right-hand corner of the Toshiba TOSVERT130-E3 VFD control board, will indicate charged capacitors. DO NOT TOUCH internal high voltage parts if LED is lit.

3. Remove jumper between ST and CC on the terminal block and replace the VFD cover. This will disable the running of the VFD. Refer to Fig. 57.
4. Close the IFCB and energize the Indoor Fan Contactor (IFC). The VFD is now powered but the fan will not operate.
5. On the front of the VFD is a keypad, which is used to change the VFD set point. At this point the drive should be disabled and the display read “OFF”. If the current output frequency is displayed then verify that the ST and CC jumpers have been removed.
6. Press either the “DOWN ARROW” or “UP ARROW” key once, this will display the current frequency set point.
7. Press either the “DOWN ARROW” or “UP ARROW” key to change set point to the appropriate duct static set point desired. This number may be adjusted based on the amount of static pressure (in. wg) required. Refer to Table 11 to identify the VFD Set Point.



NOTES:
1. Drive enable (ST to CC made).
2. No emergency off command (S4 to CC made).
3. Direction command (F or R to CC made).
4. Frequency reference (4-20mA signal at IV terminal).

Fig. 57 — Toshiba TOSVERT130-E3 VFD Factory-Installed Jumpers

8. Press “READ/WRITE” key, to enter the new value. The desired set point value will alternately flash to indicate that the new value has been stored.

IMPORTANT: The Carrier factory default values for the VFD may be different than the default values of the manufacturer. Refer to the Carrier literature when checking default values. The following default values have been changed from the manufacturer settings to closely match the VFD operation with a Carrier VAV unit. Refer to Tables 12 and 13.

9. Fire-speed override mode is available by contact closure between terminals S1 and CC.
10. If the VFD is to be controlled by an external control system, other than the factory-supplied duct static pressure transducer, follow these steps:
    a. Install a jumper between S2 and CC. This jumper will disable the PID (Proportional Integral Derivative) control loop in the VFD. The VFD is set to follow an external speed reference signal from the control system.
    b. Connect the field-supplied speed reference (4-20 mA) signal across terminals IV and P24.
11. Once all the changes have been made, open the IFCB.
12. Wait for the VFD display to go blank and remove VFD cover without touching any interior components. Make sure that the charge indicator lamp is out. If still lit, wait until lamp goes completely out. This may take several minutes.
13. Replace jumper across terminals ST and CC.
14. Replace VFD cover.
15. Close the IFCB. The VFD is now powered and the fan will operate.

Table 12 — Carrier Default Program Parameter Values

PARAMETER GROUP	PARAMETER	DEFAULT VALUE
SetP (Setup)	ACC1	60.0 Sec
	DEC1	60.0 Sec
	UL	60.0 Hz
	LL	10.0 Hz*
	Luln	1
	P3	20%
	F-P3	0.0 Hz
	P4	100%
	F-P4	60 Hz
	tHr1	See Table 13
	StC1	0
	StL1	110%
	OLN	1
	tYP	5*
Gr.F (Fundamental)	FH	60 Hz
	Pt	2
Gr.Fb (Feedback)	FbP1	1*
	Fbln	2
	GP	.30
	GI	2 sec
	GA	0
	GFS	80
	P1LL	10
	PuL	1
	PuUl	10
	PuLL	10
Gr.SF (Frequency Settings)	Fsor	60 Hz
Gr.Pn (Panel Control)	Fr	0*
Gr.St (Terminal Selection)	1t	1
	1t0	0
	1t1	56
	1t2	13
	1t3	3
	1t4	10
Gr.Pr (Protection)	UuC	1*
	UuCt	2
	ArSt	3
Gr.Ut (Utility)	Cnod	1*
	Fnod	2*
	bLPn	1*

*These settings differ from the Toshiba defaults and are required for Carrier applications.

Table 13 — Motor Electronic Thermal Protection (tHr) for Toshiba TOSVERT 130-E3 VFD

MOTOR		STANDARD EFFICIENCY					HIGH EFFICIENCY		
Hp	kW	IFM Letter*	230 V Setting	380V Setting	460V Setting	575V Setting	IFM Letter*	230V Setting	460V Setting
5	3.73	A	66	100	72	89	L	72	72
7.5	5.60	B	100	100	80	76	M	100	80
10	7.46	C	96	94	97	91	N	96	100
15	11.19	D	78	94	100	100	P	78	100
20	14.92	E	87	94	100	95	Q	82	100
25	18.65	F	86	84	94	100	R	86	91
30	22.38	G	99	—	92	100	S	86	80
40	29.84	H	89	—	85	85	T	89	85

*IFM Letter refers to the 15th digit (Motor Option) of the unit model number

TOSHIBA TOSVERT VF-S9 VFD — The VFD must be powered up, however, since it is located near the indoor fan, operation of the fan is not desirable. To disable the fan and set the duct static pressure, perform the following procedure:

1. Open the Indoor Fan Circuit Breaker (IFCB). This will shut off power to the VFD.
2. Wait for the VFD display to go blank and the charge lamplight to go out. Remove the VFD cover without touching any interior components. It may take several minutes for the VFD to fully discharge.

⚠ WARNING

A high voltage potential can exist with the indoor fan circuit breaker open. The charge lamp LED, located on the upper left corner of the Toshiba TOSVERT VF-S9 VFD front cover, will indicate charged capacitors. DO NOT TOUCH internal high voltage parts if LED is lit.

3. Remove jumper between R and CC on the terminal block and replace the VFD cover. This will disable the running of the VFD. Refer to Fig. 58.
4. Close the IFCB and energize the Indoor Fan Contactor (IFC). The VFD is now powered but the fan will not operate.
5. On the front of the VFD is a keypad, which is used to change the VFD set point. At this point the drive should be disabled and the display read “OFF”. If the current output frequency is displayed then verify that the R and CC jumpers have been removed.
6. Press either the “DOWN ARROW” or “UP ARROW” key once, this will display the current frequency set point.
7. Press either the “DOWN ARROW” or “UP ARROW” key to change set point to the appropriate duct static set point desired. This number may be adjusted based on the amount of static pressure (in. wg) required. Refer to the Table 8 to identify the VFD Set Point.
8. Press “ENT” key, to enter the new value. The desired set point value will alternately flash to indicate that the new value has been stored.

IMPORTANT: The Carrier factory default values for the VFD may be different than the default values of the manufacturer. Refer to the Carrier literature when checking default values. The following default values have been changed from the manufacturer settings to closely match the VFD operation with a Carrier VAV unit. Refer to Tables 14 and 15.

9. Fire-speed override mode is available by contact closure between terminals S1 and CC.
10. If the VFD is to be controlled by an external control system, other than the factory-supplied duct static pressure transducer, follow these steps:
    a. Install a jumper between S2 and CC. This jumper will disable the PID (Proportional Integral Derivative) control loop in the VFD. The VFD is set to follow an external speed reference signal from the control system.
    b. Connect the field-supplied speed reference (4-20 mA) signal across terminals II and P24. See Fig. 58.
11. Once all the changes have been made, open the IFCB.
12. Wait for the VFD display to go blank and the charge lamplight to go out. Remove the VFD cover without touching any interior components. It may take several minutes for the VFD to fully discharge.
13. Replace jumper across terminals R and CC.
14. Replace VFD cover.
15. Close the IFCB. The VFD is now powered and the fan will operate.

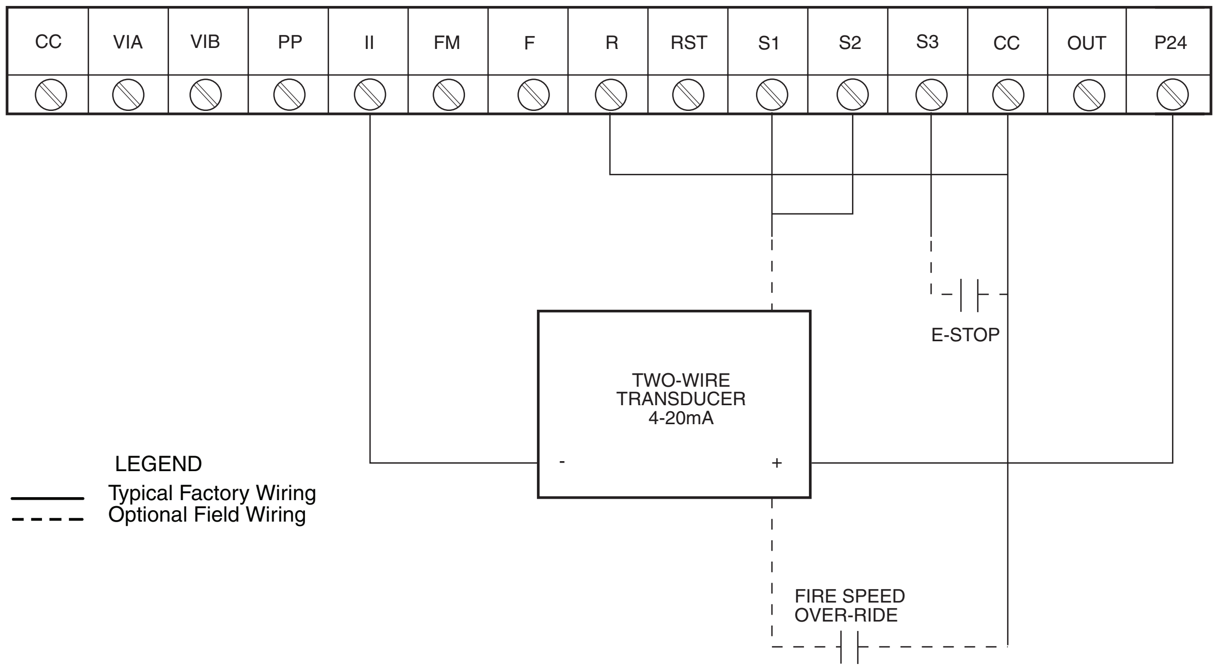


Fig. 58 — Toshiba TOSVERT VF-S9 VFD Factory-Installed Jumpers

Table 14 — Carrier VFD (Toshiba TOSVERT VF-S9) Program Parameter Values

PARAMETER GROUP	COMMUNICATION NO.	DESCRIPTION	CARRIER DEFAULT SETTINGS
Basic Parameters			
CNOd	0003	Command Mode Selection	0*
FNOd	0004	Frequency Setting Mode Selection	1*
Fr	0008	Forward/Reverse Run Selection	1*
ACC	0009	Acceleration Time 1	10.0 sec
dEC1	0010	Deceleration Time 1	10.0 sec
FH	0011	Maximum Frequency	60.0 Hz*
UL	0012	Upper Limit Frequency	60.0 Hz*
LL	0013	Lower Limit Frequency	10.0 Hz*
Pt	0015	V/f Control Mode Selection	1*
tHr	0041	Motor Electronic Thermal Protection Level 1	See Table 15*
Sr1	0018	Preset-Speed Operation Frequency 1	60.0 Hz*
Extended Parameters			
F115	0115	Input Terminal Selection 5 (S2)	14*
F116	0116	Input Terminal Selection 6 (S3)	11*
Frequency Parameters			
F201	0201	VIA/II Input Point 1 Setting	20%*
F202	0202	VIA/II Input Point 1 Frequency	0.0 Hz
F203	0203	VIA/II Input Point 2 Setting	100%
F204	0204	VIA/II Input Point 2 Frequency	60.0 Hz*
Operation Mode Parameters			
F300	0300	PWM Carrier Frequency	4 KHz*
F301	0301	Auto-Restart Control Selection	3*
F302	0302	Regenerative Power Ride-through Control	1*
F303	0303	Retry Selection (Number of Times)	2*
F360	0360	PI Control	1*
F362	0362	Proportional Gain	0.30
F363	0363	Integral Gain	0.20

*These settings differ from the Toshiba defaults and are required for Carrier applications.

Table 15 — Motor Electronic Thermal Protection (tHr) for Toshiba TOSVERT VF-S9 VFD

MOTOR		STD EFFICIENCY				HIGH EFFICIENCY		
HP	**kW**	**IFM Letter***	**230V Setting**	**380V Setting**	**460V Setting**	**IFM Letter***	**230V Setting**	**460V Setting**
5	**3.73**	A	83	77	83	L	90	83
7.5	**5.60**	B	80	88	84	M	80	84
10	**7.46**	C	85	75	86	N	85	88
15	**11.19**	D	81	98	79	P	81	79
20	**14.92**	E	94	—	87	Q	88	87

*IFM Letter refers to the 15th digit (Motor Option) of the unit model number.

Power Exhaust — The optional non-modulating power exhaust (CV only) is a two-stage design where the operation of the exhaust fans is linked to economizer position. When the supply fan is running and the economizer is 25% open, the base control board closes contacts, activating 2 (48AJ,AK,AW, AY020-050 and 48EJ,EK,EW,EY024-048) or 3 (48AJ,AK, AW,AY060 and 48EJ,EK,EW,EY054-068) exhaust fans. When the economizer position reaches 75% open, the base module activates the other 2 (48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048) or 3 (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068) exhaust fans. The fans will turn off when the economizer closes below the same points. The economizer position set points that trigger the exhaust fans can be modified, but only through use of the Service Tool, Comfort-WORKS®, or Building Supervisor software. If single-stage operation is desired, adjust the economizer set points to identical values at the desired point to activate all exhaust fans.

The optional modulating power exhaust (VAV standard, CV optional) is controlled by a modular electronic sequencer system. This system consists of a model R353 signal input module and 4 model S353 staging modules (for 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068, 6 model S353 staging modules). The signal input module receives a 0 to 10 vdc signal from the building pressure transducer, which is mounted adjacent to the supply static transducer behind the filter access panel. The modules are mounted just below the unit control board. The left module is the R353, and the 4 or 6 modules on the right are S353 modules for stages 1 through 4 or 6. On the unit wiring label, the R353 is designated PESC, and the S353 modules are designated PES1 through PES4 (PES6 for 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068).

The building pressure transducer range is -0.5 to + 0.5 in. wg. It is powered by a 0 to 10 vdc signal. A factory-installed hose at the “Lo” connection leads to atmosphere, and a field-supplied hose must be connected to the “Hi” connection and led into the building to a point where building pressure is to be controlled. There is a plug button in the bulkhead just above the transducers, for use in leading the hoses into the building via the return air ductwork.

There are 3 adjustments at the R353 module, all of which have been factory set. In the center of the circuit board is a set of 4 pins with a jumper, labeled J2. This determines the mode of operation. The bottom two pins must be jumpered for direct operation. Direct operation means that the staging modules are activated in sequence as the input signal increases.

At the upper right corner of the board is a set of 5 pins and jumper, which determines the time constant for the control. The time constant is the delay in response built into the controls. The jumper should be on the middle or bottom two pins, for the maximum time constant. The delay can be decreased, if desired, by moving the jumper progressively upward, always jumpering adjacent pins.

At the lower left corner of the board below the terminal strip is a resistor marked R27. This must be removed in order to obtain the 0 to 10 vdc signal output. There will not be a resistor on a factory-supplied module, but a resistor may be present on a replacement module and must be removed.

The R353 module has a terminal block with 7 connections available for wiring. The 2 right-hand terminals are for the 24 vac and common connections. The next 2 terminals are for the 0 to 10 vdc signal. Consult the wiring label for wire identification if replacing the module. The 3 left-hand terminals are not used for this application.

The S353 module has an LED (light-emitting diode), a set of 4 jumper pins, and 2 potentiometers. The LED will light whenever the module is activated, providing a visual indication of the number of exhaust fans running. The jumper pins are arranged in a square format. Two jumpers are used to determine the mode of operation (direct or reverse). The 2 jumpers must be arranged horizontally for direct action (factory set).

At the top of the module are two potentiometers. The left potentiometer adjusts the **offset**. The right potentiometer adjusts the **differential**. The potentiometers are factory set for a nominal 0 in. wg building pressure.

The **offset** set point is defined as the point at which a module turns off a fan, and is measured in terms of percent of the input signal. For control purposes, 0 offset is at an arbitrary “floor” which is established at 10% of the input signal, or 1 vdc. In this example, the first stage will turn off at 30% (3 vdc), and the offset potentiometer will be set at 20%. The second stage will turn off at 50% signal (5 vdc), and the offset potentiometer will be set at 40%. The fourth stage is at the maximum 75% offset, which equates to 85% signal or 8.5 vdc. The offset potentiometer is calibrated in 10% increments.

See below for building pressure to signal level.

BUILDING PRESSURE	SIGNAL LEVEL
(in. wg)	(vdc)
-0.50	2
-0.25	4
0.00	6
0.25	8
0.50	10

If the building pressure is controlled at 0 in. wg, offset of the first stage should be set at 50%, which equates to 60% of the input signal, or 6 vdc. The other stages can then be set as desired between 50% and 75%.

The default offset set points for modulating power exhaust are shown in Tables 16A and 16B.

The **differential** set point is the difference between the turn off point and the turn on point for each module. It also is calibrated in terms of percent of input signal, and has a range of 1% to 7%. The differential potentiometer is calibrated in 1% increments, and is factory set at approximately 3%. It is recommended to leave the set point at 3%, to minimize cycling of the fans.

The offset and differential potentiometers have been factory set for atmospheric pressure. Do not change these settings until there is some experience with the building. In most cases the factory settings will be satisfactory. However, if the building pressure is not being maintained as desired, then some minor adjusting on a trial and error basis can be made.

Direct Digital Controls DIP Switch Configuration — The Direct Digital Control (DDC) board must be configured for each application. The DDC board is configured through the DIP (Dual In-Line Package) switches located on the board. There are 8 DIP switches which configure 8 different applications of the DDC. See Table 17. DIP switch 1 is on the left of the block. DIP switch 8 is on the right of the block. To open a DIP switch, push the switch up with suitable tool (small-blade screwdriver). To close a DIP switch, push the switch down. Factory settings are shown in Table 18.

The DIP switch configurations are as follows:

- DIP switch 1 configures the unit to operate as a VAV or CV unit
- DIP switch 2 configures the unit to use a space sensor (VAV units) or a thermostat (CV units)
- DIP switch 3 configures the DDC for use with an electronic expansion board
- DIP switch 4 is used to field test the unit
- DIP switch 5 is used to enable occupied heating (VAV units) or specify the type of power exhaust (CV units)

- DIP switch 6 configures the Time Guard® override and, when used with the field test function, sets the minimum damper position
- DIP switch 7 configures the unit for gas heat or electric heat
- DIP switch 8 configures the unit for heat pump or air conditioner operation.

Crankcase Heater — Units are equipped with crankcase heaters. Crankcase heaters are energized as long as there is power supplied to unit. Crankcase heaters deenergize while compressors are running.

IMPORTANT: To prevent damage to compressors, crankcase heater should be energized 24-hours prior to start-up.

Evaporator Fan — Fan belt and fixed pulleys are factory-installed. See Tables 19-33 for fan performance and motor limitations data. Remove tape from fan pulley, and be sure that fans rotate in the proper direction. See Table 34 for air quantity limits. Static pressure drop for power exhaust is negligible. To alter fan performance, see Evaporator Fan Performance Adjustment section on page 91.

Condenser Fans and Motors — Condenser fans and motors are factory set. Refer to Condenser-Fan Adjustment section on page 92 as required. Be sure that fans rotate in the proper direction. Fan no. 2 (48AJ,AK,AW,AY020-030 and 48EJ,EK,EW,EY024-034), fans no. 3 and 4 (48AJ,AK,AW, AY035-050 and 48EJ,EK,EW,EY038-054), and fans no. 4, 5, and 6 (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY058-068) are cycled on the outdoor-air temperature.

The VFD will always provide the proper phase sequence to the indoor-fan motor to operate in the proper rotation regardless of the phase sequence to the unit. If on start-up, the outdoor fans operate backwards but the indoor fan operates in the correct direction, reverse any two leads to the unit main terminal block and all fans will operate in the correct direction.

Table 16A — Power Exhaust Default Set Points (48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048)

STAGE	OFFSET	DIFFERENTIAL	OFF VOLTAGE	ON VOLTAGE	OFF STATIC PRESSURE (in.wg)
1	50%	3%	6.0	6.3	0.00
2	55%	3%	6.5	6.8	0.06
3	60%	3%	7.0	7.3	0.12
4	64%	3%	7.4	7.7	0.18

Table 16B — Power Exhaust Default Set Points (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068)

STAGE	OFFSET	DIFFERENTIAL	OFF VOLTAGE	ON VOLTAGE	OFF STATIC PRESSURE (in.wg)
1	50%	3%	6.0	6.3	0.00
2	55%	3%	6.5	6.8	0.06
3	60%	3%	7.0	7.3	0.12
4	65%	3%	7.5	7.8	0.19
5	70%	3%	8.0	8.3	0.25
6	75%	3%	8.5	8.8	0.31

Table 17 — DIP Switch Configuration

<table>
<tr><th>SETTING</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td rowspan="2">OPEN</td><td rowspan="2">VAV</td><td>VAV — Space Sensor Installed</td><td rowspan="2">Expansion Board</td><td rowspan="2">Field Test ON</td><td>VAV — Occupied Heat Enabled</td><td>Time Guard® Override ON</td><td rowspan="2">Gas Heat</td><td rowspan="2">Heat Pump Operation</td></tr>
<tr><td>CV — CCN or Sensors Used</td><td>CV — Modulated Power Exhaust</td><td>IN CONJUNCTION WITH FIELD TEST — Set Minimum Damper Position</td></tr>
<tr><td rowspan="2">CLOSED</td><td rowspan="2">CV</td><td>VAV — No Space Sensor</td><td rowspan="2">Base Control Board Only</td><td rowspan="2">Field Test OFF</td><td>VAV — Occupied Heat Disabled</td><td rowspan="2">Time Guard Override OFF</td><td rowspan="2">Electric Heat</td><td rowspan="2">Air Conditioner Operation</td></tr>
<tr><td>CV — Thermostat</td><td>CV — Constant Volume Power Exhaust</td></tr>
</table>

LEGEND

CCN — Carrier Comfort Network
CV — Constant Volume
VAV — Variable Air Volume

NOTES:
1. The OPEN side of the DIP switch is marked “OPEN.” When the rocker switch is on the “OPEN” side of the switch, the switch is OPEN.
2. The configuration of DIP switches 2 and 5 are dependent on DIP switch 1. If DIP switch 1 is set to OPEN (VAV operation), then DIP switches 2 and 5 will configure VAV functions.
3. When the unit is field-tested (DIP switch 4 to OPEN), the function of DIP switch 6 changes and it is used to set the minimum damper position.
4. Recycle power to unit after modifying DIP switches. This will allow the unit to access the new configurations and update its tables.

Table 18 — DIP Switch Factory Settings

UNIT	1	2	3	4	5	6	7	8
48AJ,AW and 48EJ,EW	Closed	Closed	Closed	Closed	Closed	Closed	Open*	Closed
48AK,AY and 48EK,EY	Open	Closed	Closed	Closed	Closed	Closed	Open	Closed

*On 48EJ,EW,AJ,AW units equipped with staged gas option, DIP switch 7 should be closed.

Table 19 — Fan Performance, 48AJ,AK020-030 — Vertical Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	394	1.06	416	1.17	481	1.53	538	1.91	590	2.30	637	2.71	680	3.12	721	3.55
5,000	388	1.26	453	1.61	512	1.99	566	2.39	616	2.80	662	3.23	704	3.66	745	4.11
6,000	433	1.80	495	2.18	549	2.58	600	3.00	646	3.43	690	3.87	731	4.32	770	4.79
7,000	484	2.49	540	2.91	591	3.33	637	3.76	681	4.21	722	4.66	761	5.13	799	5.61
8,000	537	3.34	589	3.79	635	4.23	678	4.69	719	5.15	758	5.62	795	6.10	831	6.59
9,000	590	4.35	638	4.83	682	5.31	723	5.78	761	6.26	798	6.75	833	7.24	867	7.75
10,000	645	5.53	690	6.05	731	6.56	769	7.05	805	7.55	840	8.06	873	8.57	905	9.09
11,000	700	6.90	742	7.46	781	7.99	817	8.51	851	9.04	884	9.56	916	10.09	946	10.62
12,000	755	8.46	795	9.05	832	9.61	866	10.17	899	10.71	930	11.26	960	11.81	989	12.36
13,000	811	10.23	849	10.85	884	11.44	917	12.02	948	12.59	978	13.16	1006	13.73	1034	14.30
14,000	868	12.20	904	12.86	937	13.48	968	14.08	998	14.68	1026	15.27	1054	15.86	1081	16.45
15,000	924	14.40	959	15.08	990	15.73	1020	16.37	1049	16.99	1076	17.61	1103	18.22	1128	18.83

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	759	3.97	795	4.40	829	4.84	862	5.29	893	5.73	923	6.18	952	6.64	980	7.09
5,000	782	4.56	818	5.02	853	5.49	885	5.96	917	6.43	947	6.91	976	7.39	1004	7.88
6,000	807	5.26	843	5.74	876	6.23	909	6.72	940	7.22	970	7.72	999	8.23	1028	8.74
7,000	835	6.09	869	6.59	902	7.09	934	7.60	965	8.12	994	8.64	1023	9.17	1051	9.70
8,000	865	7.09	898	7.60	930	8.12	961	8.64	991	9.17	1020	9.71	1049	10.25	1076	10.80
9,000	899	8.26	931	8.78	962	9.31	992	9.84	1021	10.39	1049	10.94	1076	11.49	1103	12.05
10,000	936	9.61	967	10.15	996	10.69	1025	11.24	1053	11.79	1080	12.35	1107	12.92	1133	13.49
11,000	976	11.16	1005	11.71	1033	12.26	1060	12.82	1087	13.39	1114	13.96	1139	14.54	1165	15.12
12,000	1018	12.91	1045	13.47	1072	14.04	1099	14.61	1125	15.19	1150	15.77	1175	16.36	1199	16.96
13,000	1061	14.87	1088	15.45	1114	16.03	1139	16.62	1164	17.21	1188	17.80	—	—	—	—
14,000	1107	17.05	1132	17.64	1157	18.23	1181	18.84	—	—	—	—	—	—	—	—
15,000	1153	19.44	1178	20.05	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	1007	7.55	1033	8.02	1058	8.48	1083	8.95
5,000	1032	8.37	1058	8.86	1084	9.36	1109	9.86
6,000	1055	9.25	1081	9.77	1107	10.29	1132	10.82
7,000	1078	10.23	1105	10.77	1131	11.32	1156	11.86
8,000	1103	11.35	1129	11.90	1155	12.47	1180	13.03
9,000	1130	12.62	1155	13.19	1180	13.76	—	—
10,000	1158	14.07	1183	14.65	—	—	—	—
11,000	1189	15.71	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 20 — Fan Performance, 48AJ,AK035 — Vertical Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	433	2.01	488	2.38	539	2.76	587	3.14	633	3.54	677	3.94	719	4.36	759	4.79
8,000	480	2.73	529	3.12	576	3.53	620	3.94	662	4.35	703	4.77	742	5.21	780	5.65
9,000	528	3.59	573	4.01	615	4.44	656	4.88	695	5.32	733	5.76	769	6.21	805	6.67
10,000	577	4.62	618	5.07	657	5.52	695	5.98	731	6.44	766	6.91	800	7.38	834	7.86
11,000	627	5.83	664	6.29	700	6.77	735	7.25	769	7.74	802	8.23	834	8.73	866	9.22
12,000	677	7.22	711	7.70	745	8.20	778	8.71	810	9.22	841	9.73	871	10.25	901	10.77
13,000	728	8.80	760	9.30	791	9.82	822	10.35	852	10.89	881	11.42	910	11.96	938	12.51
14,000	779	10.59	809	11.11	838	11.65	867	12.20	895	12.75	923	13.31	950	13.87	977	14.44
15,000	831	12.60	858	13.13	886	13.68	913	14.25	940	14.83	966	15.41	992	15.99	1017	16.58
16,000	883	14.82	909	15.37	934	15.94	960	16.53	985	17.12	1010	17.72	1034	18.33	1059	18.94
17,000	935	17.28	959	17.85	983	18.43	1007	19.04	1031	19.65	1055	20.27	1078	20.89	1101	21.52
18,000	987	19.98	1010	20.56	1033	21.16	1056	21.78	1078	22.41	1101	23.05	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	797	5.22	834	5.67	869	6.12	902	6.57	934	7.04	965	7.50	995	7.98	1024	8.45
8,000	816	6.10	852	6.56	886	7.03	919	7.50	951	7.99	982	8.47	1011	8.97	1040	9.46
9,000	839	7.14	873	7.61	906	8.10	938	8.59	969	9.08	999	9.59	1028	10.10	1057	10.61
10,000	866	8.35	898	8.84	929	9.33	960	9.84	990	10.35	1019	10.87	1047	11.39	1075	11.92
11,000	897	9.73	927	10.24	956	10.75	985	11.27	1014	11.79	1041	12.33	1069	12.86	1096	13.41
12,000	930	11.29	958	11.82	986	12.35	1014	12.89	1041	13.43	1067	13.97	1093	14.53	1119	15.08
13,000	965	13.05	992	13.60	1019	14.15	1045	14.70	1071	15.26	1096	15.82	1121	16.39	1146	16.96
14,000	1003	15.00	1028	15.57	1054	16.14	1078	16.72	1103	17.29	1127	17.87	1151	18.45	1175	19.04
15,000	1042	17.17	1066	17.76	1090	18.35	1114	18.94	1138	19.54	1161	20.13	1184	20.74	—	—
16,000	1082	19.54	1106	20.16	1129	20.77	1151	21.38	1174	22.00	1196	22.61	—	—	—	—
17,000	1124	22.15	1146	22.78	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	1052	8.93	1079	9.42	1105	9.90	1131	10.39
8,000	1068	9.97	1096	10.47	1122	10.98	1148	11.50
9,000	1085	11.13	1112	11.66	1138	12.19	1164	12.72
10,000	1102	12.46	1129	13.00	1155	13.54	1181	14.09
11,000	1122	13.96	1148	14.51	1173	15.07	1198	15.64
12,000	1145	15.65	1170	16.21	1194	16.79	—	—
13,000	1170	17.53	1194	18.12	—	—	—	—
14,000	1198	19.64	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 21 — Fan Performance, 48AJ,AK040,050 — Vertical Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	512	2.98	560	3.38	604	3.79	647	4.20	688	4.62	728	5.05	766	5.49	803	5.94
9,000	561	3.90	604	4.33	645	4.77	685	5.20	723	5.65	760	6.10	796	6.55	831	7.02
10,000	611	5.00	651	5.45	689	5.91	725	6.37	761	6.84	795	7.31	829	7.79	861	8.27
11,000	662	6.27	699	6.75	734	7.23	768	7.72	801	8.21	833	8.71	865	9.20	895	9.71
12,000	714	7.74	748	8.24	780	8.75	812	9.26	843	9.77	873	10.29	903	10.81	932	11.33
13,000	766	9.41	798	9.93	828	10.46	858	11.00	887	11.54	916	12.08	944	12.62	971	13.16
14,000	819	11.29	848	11.84	877	12.39	905	12.95	932	13.51	959	14.07	986	14.63	1012	15.20
15,000	872	13.40	899	13.96	926	14.54	953	15.11	979	15.70	1004	16.28	1029	16.87	1054	17.46
16,000	925	15.74	951	16.32	976	16.91	1001	17.51	1026	18.12	1050	18.72	1074	19.33	1097	19.94
17,000	979	18.32	1003	18.92	1027	19.53	1051	20.15	1074	20.77	1097	21.40	1120	22.03	1142	22.66
18,000	1032	21.15	1055	21.77	1078	22.40	1100	23.04	1123	23.68	1145	24.33	1166	24.98	1188	25.63
19,000	1086	24.24	1108	24.88	1129	25.52	1151	26.18	1172	26.84	1193	27.51	1214	28.18	1234	28.85
20,000	1140	27.60	1161	28.25	1181	28.92	1202	29.59	1222	30.27	1242	30.95	1262	31.64	1281	32.33

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	839	6.40	874	6.86	907	7.34	940	7.81	971	8.30	1001	8.79	1030	9.29	1059	9.79
9,000	864	7.49	897	7.97	930	8.46	961	8.95	991	9.46	1021	9.97	1050	10.48	1078	11.00
10,000	893	8.76	925	9.26	955	9.76	985	10.27	1014	10.79	1043	11.31	1071	11.84	1098	12.37
11,000	925	10.21	955	10.73	984	11.25	1012	11.77	1040	12.30	1068	12.84	1095	13.38	1121	13.93
12,000	960	11.86	988	12.39	1016	12.93	1043	13.47	1069	14.02	1095	14.57	1121	15.13	1147	15.69
13,000	998	13.71	1024	14.26	1050	14.82	1076	15.38	1101	15.94	1126	16.51	1151	17.08	1175	17.66
14,000	1037	15.77	1062	16.34	1087	16.92	1111	17.49	1136	18.07	1159	18.66	1183	19.25	1206	19.84
15,000	1078	18.05	1102	18.64	1126	19.23	1149	19.83	1172	20.43	1195	21.03	1217	21.64	1239	22.25
16,000	1121	20.55	1143	21.17	1166	21.78	1188	22.40	1210	23.01	1232	23.64	1253	24.26	1275	24.89
17,000	1164	23.29	1186	23.93	1208	24.56	1229	25.20	1250	25.84	1271	26.48	1291	27.12	—	—
18,000	1209	26.28	1230	26.93	1250	27.59	1271	28.25	1291	28.91	—	—	—	—	—	—
19,000	1255	29.52	1275	30.19	1294	30.87	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	1086	10.29	1113	10.80	1139	11.31	1164	11.83
9,000	1105	11.52	1131	12.05	1157	12.58	1183	13.12
10,000	1125	12.91	1151	13.46	1177	14.01	1202	14.56
11,000	1147	14.49	1172	15.05	1197	15.61	1222	16.18
12,000	1172	16.26	1196	16.83	1220	17.41	1244	18.00
13,000	1199	18.24	1223	18.83	1246	19.42	1269	20.02
14,000	1229	20.44	1252	21.04	1274	21.64	1296	22.25
15,000	1261	22.86	1283	23.48	—	—	—	—
16,000	1296	25.52	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 22 — Fan Performance, 48AJ,AK060 — Vertical Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	476	4.33	534	5.04	585	5.78	632	6.56	674	7.39	714	8.24	751	9.12	786	10.02
14,000	536	6.19	588	6.96	636	7.74	680	8.56	720	9.41	758	10.30	793	11.21	827	12.15
15,000	566	7.28	617	8.09	662	8.90	704	9.73	744	10.59	781	11.50	816	12.42	849	13.38
16,000	597	8.48	645	9.34	689	10.17	730	11.02	768	11.90	804	12.82	839	13.76	871	14.73
17,000	628	9.80	674	10.71	717	11.58	756	12.45	793	13.34	829	14.27	862	15.23	894	16.21
18,000	659	11.25	704	12.21	745	13.11	783	14.00	819	14.91	853	15.85	886	16.82	918	17.82
19,000	691	12.82	734	13.84	773	14.77	810	15.69	845	16.62	879	17.58	911	18.56	942	19.57
20,000	723	14.53	764	15.60	802	16.57	838	17.52	872	18.47	905	19.44	936	20.44	966	21.45
21,000	755	16.37	794	17.49	831	18.51	866	19.49	899	20.47	931	21.46	961	22.47	991	23.50
22,000	787	18.35	825	19.53	861	20.59	894	21.60	927	22.61	958	23.62	987	24.64	1016	25.69
23,000	819	20.48	856	21.71	890	22.81	923	23.87	954	24.90	985	25.93	1014	26.97	1042	28.03
24,000	851	22.75	887	24.04	920	25.19	952	26.28	983	27.34	1012	28.40	1041	29.46	1068	30.54
25,000	883	25.17	918	26.52	951	27.72	982	28.84	1011	29.94	1040	31.02	1068	32.11	1095	33.21
26,000	916	27.76	950	29.15	981	30.40	1011	31.57	1040	32.70	1068	33.81	1095	34.92	1122	36.04
27,000	948	30.49	981	31.95	1012	33.24	1041	34.46	1070	35.62	1097	36.76	1123	37.90	1149	39.04

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	819	10.93	851	11.85	881	12.78	911	13.72	939	14.67	967	15.62	993	16.58	1019	17.54
14,000	859	13.11	890	14.08	920	15.06	948	16.06	976	17.07	1003	18.08	1029	19.11	1054	20.13
15,000	881	14.36	911	15.35	940	16.36	968	17.38	996	18.41	1022	19.45	1048	20.50	1073	21.56
16,000	902	15.72	932	16.73	961	17.76	989	18.80	1016	19.86	1042	20.92	1067	22.00	1092	23.08
17,000	925	17.21	954	18.24	983	19.28	1010	20.34	1036	21.42	1062	22.51	1087	23.60	1112	24.71
18,000	948	18.84	977	19.88	1005	20.94	1032	22.01	1058	23.11	1083	24.21	1108	25.33	1132	26.46
19,000	971	20.60	1000	21.65	1027	22.72	1054	23.81	1080	24.92	1105	26.04	1129	27.18	1153	28.33
20,000	995	22.50	1023	23.57	1050	24.65	1076	25.76	1102	26.88	1126	28.01	1151	29.17	1174	30.33
21,000	1019	24.55	1047	25.63	1073	26.73	1099	27.84	1124	28.97	1149	30.13	1173	31.29	1196	32.47
22,000	1044	26.76	1071	27.84	1097	28.95	1123	30.08	1147	31.22	1172	32.39	1195	33.56	—	—
23,000	1069	29.11	1096	30.21	1122	31.33	1147	32.47	1171	33.63	1195	34.80	—	—	—	—
24,000	1095	31.63	1121	32.74	1146	33.87	1171	35.02	1195	36.19	—	—	—	—	—	—
25,000	1121	34.31	1147	35.44	1171	36.58	1196	37.74	—	—	—	—	—	—	—	—
26,000	1147	37.16	1172	38.30	1197	39.46	—	—	—	—	—	—	—	—	—	—
27,000	1174	40.18	1199	41.34	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	1045	18.51	1069	19.48	1093	20.45	1117	21.43
14,000	1079	21.17	1103	22.21	1126	23.26	1149	24.31
15,000	1097	22.63	1121	23.70	1144	24.78	1167	25.86
16,000	1116	24.17	1140	25.28	1162	26.38	1185	27.49
17,000	1135	25.83	1159	26.95	1181	28.09	—	—
18,000	1156	27.60	1178	28.74	—	—	—	—
19,000	1176	29.48	1199	30.65	—	—	—	—
20,000	1197	31.50	—	—	—	—	—	—
21,000	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—
23,000	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 23 — Fan Performance, 48AW,AY020-030 — Horizontal Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	394	1.06	424	1.21	488	1.57	544	1.96	595	2.35	642	2.76	685	3.17	725	3.59
5,000	398	1.32	465	1.68	523	2.06	576	2.46	625	2.88	670	3.31	712	3.75	751	4.19
6,000	451	1.90	511	2.29	564	2.70	613	3.12	659	3.55	702	4.00	742	4.45	780	4.92
7,000	506	2.65	560	3.07	609	3.49	654	3.93	697	4.38	737	4.84	776	5.31	813	5.79
8,000	562	3.56	612	4.01	657	4.46	699	4.91	739	5.38	777	5.86	814	6.34	848	6.84
9,000	620	4.65	666	5.13	707	5.60	747	6.08	784	6.57	820	7.06	855	7.56	888	8.07
10,000	679	5.93	721	6.44	760	6.94	797	7.44	832	7.94	866	8.45	898	8.97	930	9.50
11,000	738	7.40	777	7.94	814	8.47	849	9.00	882	9.52	914	10.05	944	10.59	974	11.13
12,000	798	9.09	835	9.66	869	10.22	902	10.77	933	11.32	963	11.86	993	12.42	1021	12.98
13,000	859	11.01	893	11.60	925	12.18	956	12.75	986	13.33	1015	13.90	1042	14.47	1070	15.04
14,000	920	13.14	952	13.76	982	14.37	1011	14.97	1040	15.56	1067	16.16	1094	16.75	1120	17.34
15,000	981	15.52	1011	16.17	1040	16.80	1068	17.42	1095	18.04	1121	18.65	1146	19.27	1171	19.88

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	763	4.01	799	4.44	833	4.87	865	5.31	896	5.75	926	6.20	955	6.64	983	7.09
5,000	789	4.64	824	5.10	858	5.56	891	6.03	922	6.50	952	6.98	981	7.46	1009	7.94
6,000	817	5.39	851	5.87	885	6.36	917	6.85	948	7.34	978	7.85	1006	8.35	1034	8.86
7,000	848	6.28	881	6.78	914	7.29	945	7.80	975	8.31	1005	8.84	1033	9.36	1061	9.89
8,000	882	7.35	914	7.86	946	8.38	976	8.90	1005	9.44	1034	9.98	1062	10.52	1089	11.07
9,000	920	8.59	951	9.12	981	9.65	1010	10.19	1038	10.74	1066	11.29	1093	11.85	1119	12.41
10,000	960	10.03	990	10.57	1019	11.12	1047	11.67	1074	12.23	1101	12.79	1127	13.37	1152	13.94
11,000	1003	11.68	1032	12.23	1059	12.79	1086	13.36	1113	13.93	1138	14.51	1163	15.09	1188	15.68
12,000	1049	13.54	1076	14.11	1102	14.68	1128	15.26	1153	15.85	1178	16.43	—	—	—	—
13,000	1096	15.63	1122	16.21	1147	16.80	1172	17.39	1196	17.99	—	—	—	—	—	—
14,000	1145	17.94	1170	18.54	1194	19.15	—	—	—	—	—	—	—	—	—	—
15,000	1195	20.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	1010	7.55	1036	8.00	1061	8.46	1086	8.92
5,000	1036	8.42	1062	8.91	1088	9.40	1113	9.89
6,000	1061	9.37	1088	9.88	1113	10.40	1138	10.92
7,000	1087	10.42	1114	10.96	1139	11.50	1164	12.05
8,000	1115	11.62	1141	12.18	1166	12.74	1191	13.30
9,000	1145	12.98	1170	13.55	1195	14.13	—	—
10,000	1177	14.52	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 24 — Fan Performance, 48AW,AY035 — Horizontal Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	455	2.15	508	2.52	558	2.90	605	3.29	650	3.69	693	4.10	734	4.52	774	4.95
8,000	505	2.92	553	3.32	598	3.73	641	4.14	682	4.56	722	4.99	761	5.43	798	5.87
9,000	556	3.85	599	4.28	641	4.72	680	5.15	719	5.60	756	6.04	792	6.50	827	6.96
10,000	608	4.96	648	5.42	686	5.87	723	6.34	758	6.81	793	7.28	826	7.75	859	8.24
11,000	661	6.26	698	6.74	733	7.22	767	7.71	800	8.20	832	8.70	864	9.19	895	9.70
12,000	715	7.76	749	8.25	781	8.76	813	9.27	844	9.79	874	10.31	904	10.83	933	11.35
13,000	769	9.46	800	9.98	831	10.51	861	11.05	890	11.59	918	12.13	946	12.67	974	13.22
14,000	824	11.39	853	11.92	881	12.48	909	13.03	937	13.60	964	14.16	990	14.73	1016	15.30
15,000	879	13.54	906	14.10	933	14.67	959	15.25	985	15.84	1010	16.42	1035	17.01	1060	17.60
16,000	934	15.94	959	16.52	984	17.11	1009	17.70	1034	18.31	1058	18.92	1082	19.53	1105	20.14
17,000	989	18.58	1013	19.18	1037	19.79	1060	20.41	1084	21.03	1107	21.66	1129	22.29	1151	22.92
18,000	1044	21.49	1067	22.10	1090	22.73	1112	23.37	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	811	5.39	847	5.83	882	6.29	915	6.75	947	7.21	977	7.68	1007	8.15	1035	8.63
8,000	834	6.33	869	6.79	902	7.26	935	7.74	966	8.22	997	8.71	1026	9.21	1055	9.71
9,000	861	7.44	894	7.92	926	8.40	957	8.90	988	9.40	1017	9.90	1046	10.42	1075	10.94
10,000	891	8.73	922	9.22	953	9.72	983	10.23	1012	10.75	1041	11.27	1069	11.80	1096	12.33
11,000	925	10.20	954	10.72	983	11.24	1012	11.76	1040	12.29	1067	12.83	1094	13.37	1120	13.92
12,000	961	11.88	989	12.41	1017	12.95	1044	13.49	1070	14.04	1096	14.59	1122	15.15	1147	15.71
13,000	1000	13.76	1027	14.32	1053	14.87	1078	15.43	1104	16.00	1129	16.57	1153	17.14	1177	17.72
14,000	1041	15.86	1066	16.44	1091	17.01	1116	17.59	1140	18.18	1163	18.76	1187	19.35	—	—
15,000	1084	18.19	1108	18.79	1131	19.38	1155	19.98	1178	20.58	—	—	—	—	—	—
16,000	1128	20.75	1151	21.37	1173	21.98	1196	22.60	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	1063	9.11	1090	9.60	1115	10.09	1141	10.58
8,000	1082	10.21	1109	10.72	1135	11.23	1161	11.75
9,000	1102	11.46	1129	11.99	1155	12.52	1180	13.05
10,000	1123	12.87	1149	13.42	1175	13.97	1200	14.52
11,000	1146	14.47	1172	15.03	1197	15.60	—	—
12,000	1172	16.28	1197	16.85	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 25 — Fan Performance, 48AW,AY040,050 — Horizontal Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	536	3.18	582	3.58	626	3.99	668	4.41	708	4.83	747	5.27	785	5.71	821	6.16
9,000	588	4.17	630	4.60	670	5.04	709	5.48	746	5.93	782	6.38	818	6.84	852	7.31
10,000	642	5.35	680	5.80	717	6.27	753	6.73	787	7.20	821	7.68	854	8.16	886	8.65
11,000	696	6.72	732	7.20	766	7.69	799	8.18	831	8.67	863	9.17	893	9.68	923	10.18
12,000	751	8.29	784	8.80	816	9.32	847	9.83	877	10.35	906	10.87	935	11.40	964	11.92
13,000	807	10.09	837	10.62	867	11.16	896	11.70	924	12.24	952	12.78	979	13.33	1006	13.88
14,000	863	12.12	891	12.67	919	13.23	946	13.79	973	14.36	999	14.92	1025	15.49	1050	16.06
15,000	919	14.38	946	14.96	972	15.54	997	16.12	1023	16.71	1047	17.30	1072	17.89	1096	18.48
16,000	975	16.90	1000	17.49	1025	18.09	1049	18.70	1073	19.31	1097	19.92	1120	20.53	1143	21.15
17,000	1032	19.67	1056	20.29	1079	20.91	1102	21.54	1125	22.17	1147	22.80	1169	23.44	1191	24.07
18,000	1089	22.71	1111	23.35	1134	23.99	1155	24.64	1177	25.29	1198	25.95	1219	26.60	1240	27.26
19,000	1146	26.04	1167	26.69	1188	27.35	1209	28.02	1230	28.69	1250	29.37	1270	30.04	1290	30.72
20,000	1203	29.65	1224	30.32	1244	31.00	1263	31.69	1283	32.38	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	857	6.63	891	7.09	923	7.57	955	8.05	986	8.54	1016	9.03	1045	9.53	1073	10.03
9,000	885	7.79	918	8.28	949	8.77	980	9.27	1010	9.77	1039	10.28	1067	10.80	1095	11.32
10,000	917	9.14	948	9.65	978	10.15	1008	10.67	1036	11.19	1064	11.72	1092	12.25	1119	12.79
11,000	953	10.70	982	11.21	1010	11.74	1038	12.27	1066	12.81	1093	13.35	1119	13.90	1145	14.45
12,000	991	12.46	1019	12.99	1046	13.53	1072	14.08	1098	14.63	1124	15.19	1149	15.76	1174	16.32
13,000	1032	14.43	1058	14.99	1084	15.55	1109	16.11	1134	16.68	1158	17.26	1182	17.84	1206	18.42
14,000	1075	16.64	1100	17.21	1124	17.79	1148	18.38	1171	18.97	1195	19.55	1218	20.15	1241	20.75
15,000	1120	19.08	1143	19.68	1166	20.27	1189	20.88	1211	21.49	1234	22.09	1256	22.71	1277	23.32
16,000	1165	21.76	1188	22.38	1210	23.00	1231	23.62	1253	24.25	1274	24.88	1295	25.51	—	—
17,000	1213	24.71	1234	25.35	1255	25.99	1276	26.63	1296	27.27	—	—	—	—	—	—
18,000	1261	27.92	1281	28.58	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	1100	10.54	1126	11.05	1152	11.56	1177	12.08
9,000	1122	11.85	1148	12.38	1174	12.91	1199	13.45
10,000	1145	13.33	1171	13.88	1196	14.43	1221	14.99
11,000	1171	15.01	1196	15.57	1220	16.14	1245	16.72
12,000	1199	16.90	1223	17.48	1247	18.06	1270	18.65
13,000	1230	19.01	1253	19.60	1276	20.20	1299	20.80
14,000	1263	21.35	1285	21.96	—	—	—	—
15,000	1299	23.94	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 26 — Fan Performance, 48AW,AY060 — Horizontal Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	516	4.81	569	5.54	617	6.30	660	7.10	701	7.93	739	8.79	774	9.68	808	10.59
14,000	584	6.90	632	7.69	676	8.50	716	9.33	754	10.20	790	11.10	824	12.02	857	12.97
15,000	619	8.13	664	8.96	706	9.79	745	10.65	782	11.53	817	12.44	850	13.38	882	14.35
16,000	654	9.49	697	10.36	737	11.22	775	12.10	811	13.00	845	13.93	877	14.88	908	15.86
17,000	689	10.99	730	11.90	769	12.79	806	13.69	840	14.61	873	15.56	904	16.53	935	17.52
18,000	725	12.64	764	13.58	801	14.51	837	15.43	870	16.38	902	17.34	933	18.32	962	19.33
19,000	760	14.43	798	15.41	834	16.37	868	17.32	900	18.29	932	19.27	961	20.27	990	21.29
20,000	796	16.37	833	17.39	867	18.39	900	19.37	931	20.36	962	21.36	991	22.38	1019	23.42
21,000	832	18.47	867	19.54	901	20.56	932	21.57	963	22.59	992	23.61	1020	24.65	1048	25.71
22,000	869	20.74	902	21.84	934	22.90	965	23.94	995	24.98	1023	26.03	1051	27.09	1077	28.17
23,000	905	23.17	937	24.31	968	25.40	998	26.48	1027	27.55	1055	28.62	1081	29.70	1107	30.79
24,000	942	25.78	973	26.95	1003	28.08	1032	29.18	1059	30.28	1086	31.38	1113	32.48	1138	33.59
25,000	978	28.56	1008	29.77	1037	30.93	1065	32.07	1092	33.20	1119	34.32	1144	35.44	1169	36.58
26,000	1015	31.52	1044	32.76	1072	33.96	1099	35.13	1125	36.29	1151	37.44	1176	38.59	—	—
27,000	1052	34.66	1080	35.94	1107	37.18	1133	38.38	1159	39.57	1184	40.75	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	841	11.52	872	12.46	901	13.42	930	14.38	958	15.36	985	16.34	1011	17.33	1036	18.33
14,000	888	13.94	917	14.92	946	15.92	974	16.94	1001	17.97	1027	19.01	1052	20.06	1077	21.12
15,000	912	15.33	941	16.34	970	17.36	997	18.40	1024	19.45	1049	20.51	1074	21.58	1099	22.67
16,000	938	16.86	966	17.88	994	18.93	1021	19.98	1047	21.05	1072	22.14	1097	23.23	1121	24.34
17,000	964	18.54	992	19.58	1019	20.63	1045	21.70	1071	22.79	1096	23.89	1120	25.01	1144	26.13
18,000	990	20.36	1018	21.41	1045	22.48	1070	23.57	1096	24.67	1120	25.79	1144	26.93	1167	28.07
19,000	1018	22.34	1045	23.40	1071	24.49	1096	25.59	1121	26.71	1145	27.84	1169	28.99	1192	30.16
20,000	1046	24.48	1072	25.56	1098	26.66	1123	27.77	1147	28.90	1171	30.05	1194	31.21	—	—
21,000	1074	26.78	1100	27.87	1125	28.99	1150	30.12	1173	31.26	1197	32.42	—	—	—	—
22,000	1103	29.26	1129	30.36	1153	31.49	1177	32.63	—	—	—	—	—	—	—	—
23,000	1133	31.90	1157	33.02	1181	34.16	—	—	—	—	—	—	—	—	—	—
24,000	1163	34.72	1187	35.86	—	—	—	—	—	—	—	—	—	—	—	—
25,000	1193	37.72	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	1061	19.33	1085	20.34	1108	21.35	1131	22.36
14,000	1101	22.18	1125	23.25	1148	24.33	1170	25.42
15,000	1122	23.76	1146	24.86	1168	25.97	1191	27.08
16,000	1144	25.45	1167	26.58	1190	27.71	—	—
17,000	1167	27.27	1190	28.42	—	—	—	—
18,000	1190	29.23	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—
21,000	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—
23,000	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 27 — Fan Performance, 48EJ,EK024,034 — Vertical Discharge Units

(For EW,EY units, reduce net available external static pressure by 0.3 in. wg)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	340	0.83	416	1.17	480	1.52	537	1.90	588	2.29	635	2.69	679	3.11	720	3.53
5,000	384	1.25	453	1.61	513	1.99	566	2.39	615	2.79	660	3.21	703	3.64	742	4.08
6,000	432	1.79	495	2.19	550	2.59	600	3.01	647	3.43	690	3.87	730	4.31	769	4.77
7,000	483	2.48	540	2.91	591	3.33	638	3.77	682	4.22	723	4.67	762	5.14	799	5.61
8,000	536	3.33	588	3.78	635	4.23	679	4.69	720	5.16	759	5.64	797	6.12	832	6.61
8,250	549	3.57	600	4.02	646	4.48	690	4.95	730	5.42	769	5.90	806	6.39	841	6.88
9,000	590	4.34	637	4.82	681	5.30	722	5.78	762	6.27	799	6.77	834	7.27	868	7.77
10,000	645	5.54	689	6.04	729	6.54	768	7.04	805	7.56	840	8.07	874	8.59	906	9.12
11,000	701	6.92	741	7.44	779	7.96	816	8.49	850	9.03	884	9.56	916	10.10	947	10.65
12,000	757	8.49	795	9.04	830	9.59	865	10.14	898	10.69	929	11.25	960	11.81	990	12.37
12,500	786	9.36	822	9.92	856	10.47	890	11.03	922	11.60	953	12.16	983	12.73	1012	13.31
13,000	814	10.28	849	10.84	883	11.41	915	11.98	946	12.56	976	13.13	1006	13.71	1034	14.30
13,750	857	11.75	890	12.34	922	12.92	953	13.51	983	14.10	1012	14.69	1041	15.28	1068	15.88
14,000	871	12.27	904	12.86	936	13.45	966	14.05	996	14.64	1025	15.23	1053	15.83	1080	16.43
15,000	929	14.50	960	15.10	990	15.71	1019	16.33	1047	16.94	1074	17.55	1101	18.17	1127	18.79

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	759	3.97	796	4.42	831	4.87	865	5.34	897	5.81	929	6.30	959	6.79	988	7.28
5,000	780	4.53	816	4.99	851	5.45	884	5.93	916	6.41	946	6.90	976	7.40	1005	7.91
6,000	805	5.23	840	5.70	874	6.18	906	6.67	937	7.16	968	7.66	997	8.17	1025	8.69
7,000	834	6.09	868	6.57	901	7.07	932	7.56	962	8.07	992	8.58	1020	9.10	1048	9.63
8,000	866	7.10	899	7.60	930	8.11	961	8.62	990	9.14	1019	9.67	1047	10.20	1074	10.74
8,250	874	7.38	907	7.89	938	8.40	968	8.92	998	9.44	1026	9.97	1054	10.50	1081	11.04
9,000	901	8.29	932	8.80	963	9.33	992	9.86	1021	10.39	1049	10.93	1076	11.48	1102	12.03
10,000	938	9.65	968	10.18	997	10.72	1026	11.27	1054	11.82	1081	12.37	1107	12.93	1133	13.49
11,000	977	11.19	1006	11.75	1035	12.30	1062	12.87	1089	13.43	1115	14.00	1141	14.57	1166	15.15
12,000	1019	12.94	1047	13.51	1074	14.08	1100	14.66	1126	15.24	1152	15.83	1177	16.42	1201	17.01
12,500	1040	13.88	1067	14.46	1094	15.05	1120	15.63	1146	16.22	1171	16.82	1195	17.41	—	—
13,000	1062	14.88	1089	15.47	1115	16.06	1140	16.66	1166	17.25	1190	17.86	—	—	—	—
13,750	1095	16.48	1121	17.08	1147	17.68	1172	18.29	1196	18.90	—	—	—	—	—	—
14,000	1106	17.04	1132	17.64	1157	18.25	1182	18.86	—	—	—	—	—	—	—	—
15,000	1152	19.41	1177	20.04	1200	20.66	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)					
	3.4		3.6		3.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	1017	7.79	1045	8.30	1072	8.82
5,000	1033	8.42	1061	8.94	1087	9.46
6,000	1053	9.21	1080	9.73	1106	10.27
7,000	1075	10.16	1102	10.69	1127	11.24
8,000	1100	11.28	1126	11.83	1151	12.38
8,250	1107	11.59	1133	12.14	1158	12.69
9,000	1128	12.58	1153	13.14	1178	13.70
10,000	1158	14.06	1183	14.63	—	—
11,000	1190	15.74	—	—	—	—
12,000	—	—	—	—	—	—
12,500	—	—	—	—	—	—
13,000	—	—	—	—	—	—
13,750	—	—	—	—	—	—
14,000	—	—	—	—	—	—
15,000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 28 — Fan Performance, 48EJ,EK038,044 — Vertical Discharge Units

(For EW,EY units, reduce net available external static pressure by 0.5 in. wg)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	429	1.70	484	2.40	536	2.70	584	3.10	630	3.50	674	3.90	716	4.30	756	4.80
8,000	475	2.36	525	3.09	571	3.49	616	3.90	658	4.31	699	4.74	738	5.17	776	5.61
9,000	523	3.11	567	3.97	610	4.39	651	4.82	690	5.26	728	5.71	765	6.16	801	6.62
10,000	571	4.00	612	5.01	651	5.46	689	5.91	725	6.37	761	6.84	795	7.31	829	7.79
11,000	620	5.04	658	6.22	694	6.69	729	7.17	763	7.65	796	8.14	829	8.64	860	9.14
12,000	670	6.24	705	7.61	738	8.10	771	8.60	803	9.11	834	9.62	865	10.13	894	10.65
13,000	720	7.61	752	9.19	784	9.70	814	10.23	844	10.75	874	11.29	902	11.82	931	12.36
14,000	771	9.15	801	10.97	830	11.51	859	12.05	887	12.60	915	13.15	942	13.71	969	14.27
15,000	822	10.88	850	12.95	877	13.52	904	14.08	931	14.65	957	15.22	983	15.80	1008	16.38
16,000	873	12.80	899	15.16	925	15.74	951	16.33	976	16.92	1001	17.51	1025	18.11	1049	18.71
17,000	924	14.91	949	17.59	974	18.20	998	18.80	1022	19.41	1045	20.03	1069	20.64	1092	21.26
18,000	976	17.24	999	20.26	1023	20.88	1046	21.51	1068	22.14	1091	22.77	1113	23.41	1135	24.05
19,000	1027	19.77	1050	23.17	1072	23.82	1094	24.46	1115	25.11	1137	25.76	1158	26.42	1179	27.07
20,000	1079	22.53	1100	26.33	1122	27.00	1142	27.66	1163	28.33	1183	29.00	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	794	5.20	832	5.62	868	6.06	903	6.52	937	6.98	971	7.44	1003	7.92	1035	8.40
8,000	813	6.06	848	6.52	883	6.98	916	7.45	949	7.92	981	8.40	1012	8.89	1042	9.38
9,000	835	7.09	869	7.56	902	8.04	934	8.53	965	9.02	995	9.52	1025	10.02	1054	10.53
10,000	862	8.28	893	8.77	925	9.27	955	9.77	985	10.28	1014	10.79	1043	11.31	1071	11.84
11,000	891	9.64	921	10.15	951	10.67	980	11.19	1008	11.71	1036	12.24	1064	12.78	1090	13.32
12,000	924	11.18	952	11.71	980	12.24	1008	12.78	1035	13.32	1062	13.87	1088	14.42	1114	14.98
13,000	958	12.91	986	13.45	1012	14.01	1039	14.56	1064	15.13	1090	15.69	1115	16.26	1140	16.83
14,000	995	14.83	1021	15.40	1046	15.97	1071	16.55	1096	17.13	1120	17.71	1144	18.29	1168	18.89
15,000	1033	16.96	1058	17.55	1082	18.14	1106	18.73	1130	19.33	1153	19.93	1176	20.54	1199	21.14
16,000	1073	19.31	1097	19.92	1120	20.52	1143	21.14	1165	21.75	1188	22.37	—	—	—	—
17,000	1114	21.88	1137	22.51	1159	23.13	1181	23.76	—	—	—	—	—	—	—	—
18,000	1156	24.69	1178	25.33	1199	25.98	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)					
	3.4		3.6		3.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	1066	8.88	1096	9.38	1125	9.88
8,000	1072	9.88	1101	10.39	1130	10.90
9,000	1083	11.04	1111	11.56	1139	12.08
10,000	1098	12.37	1125	12.90	1152	13.44
11,000	1117	13.86	1143	14.41	1169	14.96
12,000	1139	15.54	1164	16.11	1189	16.68
13,000	1164	17.41	1188	17.99	—	—
14,000	1191	19.48	—	—	—	—
15,000	—	—	—	—	—	—
16,000	—	—	—	—	—	—
17,000	—	—	—	—	—	—
18,000	—	—	—	—	—	—
19,000	—	—	—	—	—	—
20,000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp} \times 746}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 29 — Fan Performance, 48EJ,EK048 — Vertical Discharge Units

(For EW,EY units, reduce net available external static pressure by 0.5 in. wg)

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
9,000	528	3.20	572	4.00	615	4.40	656	4.90	695	5.30	733	5.80	769	6.20	805	6.70
10,000	577	4.10	617	5.10	657	5.50	694	6.00	731	6.40	766	6.90	801	7.40	834	7.90
11,000	627	5.10	664	6.30	700	6.80	735	7.30	769	7.70	802	8.20	835	8.70	866	9.20
12,000	677	6.30	711	7.70	745	8.20	778	8.70	809	9.20	841	9.70	871	10.20	901	10.80
13,000	728	7.71	760	9.31	791	9.83	822	10.35	851	10.88	881	11.42	909	11.95	938	12.50
14,000	779	9.28	809	11.11	838	11.65	867	12.20	895	12.75	923	13.31	950	13.87	976	14.43
15,000	830	11.03	858	13.13	886	13.69	913	14.26	939	14.83	966	15.41	991	15.99	1017	16.57
16,000	882	12.97	908	15.36	934	15.95	960	16.54	985	17.13	1010	17.73	1034	18.33	1058	18.93
17,000	934	15.12	959	17.83	983	18.44	1008	19.05	1031	19.66	1055	20.28	1078	20.89	1101	21.52
18,000	986	17.47	1010	20.53	1033	21.16	1056	21.79	1078	22.42	1101	23.06	1123	23.70	1145	24.34
19,000	1038	20.05	1061	23.49	1083	24.13	1105	24.78	1126	25.44	1147	26.09	1169	26.75	1190	27.41
20,000	1091	22.84	1112	26.69	1133	27.36	1154	28.03	1174	28.70	1195	29.37	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
9,000	839	7.10	873	7.62	905	8.10	937	8.59	968	9.08	999	9.57	1028	10.08	1057	10.58
10,000	866	8.40	898	8.85	929	9.34	959	9.85	989	10.36	1018	10.87	1047	11.39	1075	11.91
11,000	897	9.70	927	10.24	956	10.76	985	11.28	1013	11.81	1041	12.34	1068	12.87	1095	13.41
12,000	930	11.30	958	11.82	986	12.36	1014	12.90	1041	13.44	1067	13.99	1093	14.54	1119	15.10
13,000	965	13.04	992	13.59	1019	14.15	1045	14.71	1071	15.27	1096	15.84	1121	16.41	1146	16.98
14,000	1002	14.99	1028	15.56	1054	16.14	1079	16.71	1103	17.30	1127	17.88	1151	18.47	1175	19.06
15,000	1041	17.15	1066	17.74	1090	18.34	1114	18.93	1138	19.53	1161	20.13	1184	20.74	—	—
16,000	1082	19.52	1105	20.14	1128	20.75	1151	21.37	1174	21.99	1196	22.61	—	—	—	—
17,000	1124	22.14	1146	22.77	1168	23.40	1190	24.03	—	—	—	—	—	—	—	—
18,000	1166	24.98	1188	25.63	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)					
	3.4		3.6		3.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
9,000	1086	11.10	1114	11.61	1141	12.14
10,000	1102	12.44	1129	12.97	1155	13.51
11,000	1122	13.96	1147	14.51	1173	15.06
12,000	1144	15.66	1169	16.23	1194	16.80
13,000	1170	17.56	1194	18.14	—	—
14,000	1198	19.66	—	—	—	—
15,000	—	—	—	—	—	—
16,000	—	—	—	—	—	—
17,000	—	—	—	—	—	—
18,000	—	—	—	—	—	—
19,000	—	—	—	—	—	—
20,000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 30 — Fan Performance, 48EJ,EK054-068 — Vertical Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
10,000	420	2.89	486	3.60	539	4.27	584	4.93	624	5.59	660	6.25	694	6.91	725	7.57
12,000	473	4.27	537	5.10	589	5.87	633	6.62	673	7.36	709	8.10	742	8.83	773	9.56
15,000	556	7.05	616	8.06	666	8.99	709	9.89	748	10.76	783	11.62	816	12.47	846	13.31
16,000	584	8.18	643	9.25	692	10.24	735	11.19	773	12.11	808	13.01	841	13.90	871	14.78
17,000	612	9.42	670	10.56	718	11.60	760	12.60	799	13.56	833	14.51	866	15.44	896	16.36
18,000	640	10.78	697	11.98	745	13.08	786	14.12	824	15.13	859	16.12	891	17.10	921	18.06
19,000	669	12.26	724	13.51	771	14.67	813	15.77	850	16.83	884	17.86	916	18.87	946	19.88
20,000	698	13.86	752	15.17	798	16.38	839	17.53	876	18.64	910	19.72	942	20.78	972	21.82
21,000	726	15.58	780	16.96	825	18.22	866	19.42	902	20.58	936	21.71	968	22.81	997	23.89
22,000	756	17.44	808	18.87	853	20.19	892	21.45	929	22.65	962	23.82	993	24.97	1023	26.10
23,000	785	19.43	836	20.92	880	22.30	919	23.60	955	24.86	988	26.08	1019	27.27	1049	28.44
24,000	814	21.56	864	23.11	907	24.54	946	25.90	982	27.20	1015	28.47	1045	29.70	1074	30.91
25,000	843	23.83	892	25.44	935	26.92	973	28.33	1008	29.68	1041	31.00	1072	32.28	1100	33.53
26,000	873	26.25	921	27.91	963	29.45	1001	30.91	1035	32.31	1068	33.67	1098	35.00	1127	36.29
27,000	903	28.82	950	30.53	991	32.12	1028	33.63	1062	35.09	1094	36.49	1124	37.86	1153	39.21

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
10,000	755	8.24	783	8.92	809	9.60	835	10.29	859	10.98	883	11.68	905	12.39	927	13.10
12,000	802	10.30	830	11.04	857	11.78	882	12.52	906	13.27	930	14.03	953	14.79	974	15.55
15,000	875	14.15	903	14.99	929	15.83	954	16.67	978	17.51	1002	18.35	1024	19.19	1046	20.04
16,000	900	15.65	927	16.53	954	17.40	979	18.27	1003	19.14	1026	20.01	1048	20.89	1070	21.76
17,000	925	17.27	952	18.18	978	19.09	1003	19.99	1027	20.90	1050	21.80	1072	22.70	1094	23.61
18,000	950	19.01	977	19.95	1003	20.90	1028	21.84	1051	22.77	1075	23.71	1097	24.64	1118	25.58
19,000	975	20.87	1002	21.85	1028	22.83	1052	23.80	1076	24.77	1099	25.74	1121	26.71	1143	27.67
20,000	1000	22.85	1027	23.87	1052	24.89	1077	25.90	1101	26.90	1124	27.90	1146	28.90	1167	29.90
21,000	1025	24.96	1052	26.02	1077	27.07	1102	28.12	1126	29.16	1148	30.19	1170	31.23	1192	32.26
22,000	1051	27.21	1077	28.31	1103	29.40	1127	30.48	1151	31.55	1173	32.62	1195	33.69	—	—
23,000	1076	29.59	1103	30.73	1128	31.85	1152	32.97	1176	34.08	1198	35.19	—	—	—	—
24,000	1102	32.11	1128	33.28	1153	34.45	1178	35.61	1201	36.75	—	—	—	—	—	—
25,000	1128	34.77	1154	35.99	1179	37.19	—	—	—	—	—	—	—	—	—	—
26,000	1154	37.57	1180	38.83	—	—	—	—	—	—	—	—	—	—	—	—
27,000	1180	40.53	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)					
	3.4		3.6		3.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
10,000	949	13.81	970	14.54	990	15.26
12,000	996	16.31	1016	17.09	1037	17.86
15,000	1067	20.88	1088	21.73	1108	22.59
16,000	1091	22.64	1112	23.52	1131	24.40
17,000	1115	24.51	1136	25.42	1156	26.33
18,000	1139	26.51	1160	27.45	1180	28.39
19,000	1164	28.64	1184	29.60	—	—
20,000	1188	30.90	—	—	—	—
21,000	—	—	—	—	—	—
22,000	—	—	—	—	—	—
23,000	—	—	—	—	—	—
24,000	—	—	—	—	—	—
25,000	—	—	—	—	—	—
26,000	—	—	—	—	—	—
27,000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on dry coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp} \times 746}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton in the cooling mode. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 31 — Fan Performance, 48EW,EY054-068 — Horizontal Discharge Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
10,000	447	2.9	508	3.6	558	4.2	601	4.8	640	5.4	675	6.0	707	6.6	738	7.3
12,000	509	4.4	567	5.1	615	5.8	657	6.5	695	7.2	729	7.9	761	8.6	791	9.3
15,000	606	7.3	659	8.2	704	9.0	744	9.9	780	10.7	813	11.5	844	12.2	874	13.0
16,000	639	8.5	690	9.4	734	10.3	773	11.2	809	12.0	842	12.9	873	13.7	902	14.5
17,000	672	9.8	721	10.8	765	11.7	803	12.6	838	13.5	871	14.4	901	15.3	930	16.1
18,000	705	11.2	753	12.3	795	13.3	833	14.2	868	15.1	900	16.1	930	17.0	959	17.8
19,000	738	12.8	785	13.9	826	14.9	864	15.9	898	16.9	929	17.8	959	18.8	987	19.7
20,000	772	14.5	817	15.6	858	16.7	894	17.7	928	18.8	959	19.7	989	20.7	1016	21.7
21,000	806	16.3	850	17.5	889	18.6	925	19.7	958	20.8	989	21.8	1018	22.8	1046	23.8
22,000	840	18.3	883	19.5	921	20.7	956	21.8	989	22.9	1019	24.0	1048	25.0	1075	26.1
23,000	874	20.4	915	21.7	953	22.9	987	24.1	1019	25.2	1049	26.3	1078	27.4	1105	28.5
24,000	908	22.7	948	24.0	985	25.3	1019	26.5	1050	27.6	1080	28.8	1108	29.9	1135	31.0
25,000	942	25.1	982	26.5	1018	27.8	1051	29.0	1082	30.2	1111	31.4	1138	32.6	1165	33.7
26,000	976	27.7	1015	29.1	1050	30.4	1083	31.7	1113	33.0	1142	34.2	1169	35.4	1195	36.6
27,000	1011	30.4	1048	31.9	1083	33.2	1115	34.6	1145	35.9	1173	37.1	1200	38.4	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)															
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
10,000	766	7.9	794	8.50	820	9.13	844	9.76	868	10.40	891	11.04	914	11.69	935	12.34
12,000	820	9.9	847	10.62	872	11.30	897	11.99	921	12.68	943	13.37	965	14.07	987	14.77
15,000	901	13.8	928	14.59	953	15.36	977	16.14	1001	16.92	1023	17.69	1045	18.47	1066	19.26
16,000	929	15.3	955	16.14	981	16.95	1005	17.75	1028	18.56	1050	19.37	1072	20.18	1093	20.98
17,000	957	17.0	983	17.81	1008	18.65	1032	19.49	1055	20.33	1077	21.16	1099	22.00	1120	22.84
18,000	986	18.7	1011	19.60	1036	20.48	1060	21.35	1083	22.22	1105	23.08	1126	23.95	1147	24.82
19,000	1014	20.6	1040	21.53	1064	22.43	1088	23.34	1110	24.24	1132	25.14	1154	26.03	1174	26.93
20,000	1043	22.6	1068	23.58	1092	24.52	1116	25.46	1138	26.39	1160	27.32	1181	28.25	—	—
21,000	1072	24.8	1097	25.78	1121	26.75	1144	27.72	1167	28.68	1188	29.64	—	—	—	—
22,000	1101	27.1	1126	28.11	1150	29.12	1173	30.12	1195	31.11	—	—	—	—	—	—
23,000	1130	29.5	1155	30.58	1179	31.62	—	—	—	—	—	—	—	—	—	—
24,000	1160	32.1	1184	33.20	—	—	—	—	—	—	—	—	—	—	—	—
25,000	1190	34.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)					
	3.4		3.6		3.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
10,000	956	12.99	976	13.66	996	14.32
12,000	1008	15.48	1028	16.19	1047	16.90
15,000	1087	20.04	1106	20.82	1126	21.61
16,000	1113	21.80	1133	22.61	1152	23.42
17,000	1140	23.68	1160	24.52	1179	25.36
18,000	1167	25.68	1187	26.55	—	—
19,000	1195	27.82	—	—	—	—
20,000	—	—	—	—	—	—
21,000	—	—	—	—	—	—
22,000	—	—	—	—	—	—
23,000	—	—	—	—	—	—
24,000	—	—	—	—	—	—
25,000	—	—	—	—	—	—
26,000	—	—	—	—	—	—
27,000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Fan performance is based on dry coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.
2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor Efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton in the cooling mode. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 32A — Fan Performance — Power Exhaust, 48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048

AIRFLOW (Cfm)	LOW SPEED						MEDIUM SPEED						HIGH SPEED					
	208 v			230, 460, 575 v			208 v			230, 460, 575 v			208 v			230, 460, 575 v		
	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts
6,500	0.32	2.82	3160	0.70	2.98	3340	—	—	—	—	—	—	—	—	—	—	—	—
6,700	0.23	2.87	3220	0.63	3.03	3400	0.60	3.01	3380	0.82	3.23	3620	—	—	—	—	—	—
6,900	0.17	2.92	3270	0.59	3.09	3460	0.55	3.07	3440	0.78	3.28	3680	—	—	—	—	—	—
7,100	0.13	2.93	3290	0.56	3.11	3490	0.49	3.12	3500	0.73	3.34	3740	—	—	—	—	—	—
7,300	0.09	2.97	3330	0.53	3.15	3530	0.43	3.18	3560	0.68	3.39	3800	—	—	—	—	—	—
7,500	—	—	—	0.51	3.19	3580	0.39	3.24	3630	0.64	3.44	3860	—	—	—	—	—	—
7,700	—	—	—	0.48	3.23	3620	0.33	3.27	3670	0.59	3.48	3900	0.60	3.69	4140	0.73	3.98	4460
7,900	—	—	—	0.45	3.27	3670	0.27	3.32	3720	0.54	3.52	3950	0.56	3.74	4190	0.69	4.02	4510
8,100	—	—	—	0.40	3.33	3730	0.22	3.36	3770	0.49	3.57	4000	0.51	3.78	4240	0.65	4.07	4560
8,500	—	—	—	—	—	—	0.17	3.47	3890	0.40	3.67	4120	0.41	3.83	4290	0.56	4.12	4620
8,900	—	—	—	—	—	—	0.00	3.58	4010	0.30	3.77	4230	0.31	3.93	4410	0.47	4.23	4740
9,300	—	—	—	—	—	—	—	—	—	0.22	3.87	4340	0.20	4.07	4560	0.37	4.37	4900
9,700	—	—	—	—	—	—	—	—	—	0.16	3.95	4430	0.11	4.17	4670	0.30	4.47	5010
10,100	—	—	—	—	—	—	—	—	—	0.12	4.03	4520	0.04	4.25	4770	0.23	4.56	5110
10,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.17	4.66	5220
10,900	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.12	4.75	5330
11,300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.07	4.80	5380
11,700	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04	4.83	5420

LEGEND

Bhp — Brake Horsepower
ESP — External Static Pressure (in. wg)
Watts — Input Watts to Motor

Table 32B — Fan Performance — Power Exhaust, 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068

AIRFLOW (Cfm)	LOW SPEED						MEDIUM SPEED						HIGH SPEED					
	208 v			230, 460, 575 v			208 v			230, 460, 575 v			208 v			230, 460, 575 v		
	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts	ESP	Bhp	Watts
9,750	0.32	4.23	4740	0.70	4.47	5010	—	—	— —	—	—	—	—	—	—	—	—	—
10,050	0.23	4.31	4830	0.63	4.55	5100	0.60	4.52	5070	0.82	4.84	5430	—	—	—	—	—	—
10,350	0.17	4.37	4905	0.59	4.63	5190	0.55	4.60	5160	0.78	4.92	5520	—	—	—	—	—	—
10,650	0.13	4.40	4935	0.56	4.67	5235	0.49	4.68	5250	0.73	5.00	5610	—	—	—	—	—	—
10,950	0.09	4.46	4995	0.53	4.72	5295	0.43	4.76	5340	0.68	5.08	5700	—	—	—	—	—	—
11,250	—	—	—	0.51	4.79	5370	0.39	4.86	5445	0.64	5.16	5790	—	—	—	—	—	—
11,550	—	—	—	0.48	4.84	5430	0.33	4.91	5505	0.59	5.22	5850	0.60	5.54	6210	0.73	5.97	6690
11,850	—	—	—	0.45	4.91	5505	0.27	4.98	5580	0.54	5.28	5925	0.56	5.61	6285	0.69	6.03	6765
12,150	—	—	—	0.40	4.99	5595	0.22	5.04	5655	0.49	5.35	6000	0.51	5.67	6360	0.65	6.10	6840
12,750	—	—	—	—	—	—	0.17	5.20	5835	0.40	5.51	6180	0.41	5.74	6435	0.56	6.18	6930
13,350	—	—	—	—	—	—	0.00	5.36	6015	0.30	5.66	6345	0.31	5.90	6615	0.47	6.34	7110
13,950	—	—	—	—	—	—	—	—	—	0.22	5.81	6510	0.20	6.10	6840	0.37	6.56	7350
14,550	—	—	—	—	—	—	—	—	—	0.16	5.93	6645	0.11	6.25	7005	0.30	6.70	7515
15,150	—	—	—	—	—	—	—	—	—	0.12	6.05	6780	0.04	6.38	7155	0.23	6.84	7665
15,750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.17	6.98	7830
16,350	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.12	7.13	7995
16,950	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.07	7.20	8070
17,550	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04	7.25	8130

LEGEND

Bhp — Brake Horsepower
ESP — External Static Pressure (in. wg)
Watts — Input Watts to Motor

Table 33 — Motor Limitations

STANDARD EFFICIENCY MOTORS						
Nominal Bhp	**Maximum Bhp**	**Maximum Amps**			**Maximum Watts**	**Maximum Efficiency**
		230 v	**460 v**	**575 v**		
5	5.9	14.6	7.9	6.0	5,030	87.5
7.5	8.7	22.0	—	—	7,717	84.1
	9.5	—	12.0	10.0	8,008	88.5
10	10.2	28.0	—	—	8,502	89.5
	11.8	—	14.6	12.0	9,836	89.5
15	15.3	43.8	—	—	12,543	91.0
	18.0	—	21.9	19.0	14,756	91.0
20	22.4	62.0	—	—	18,363	91.0
	23.4	—	28.7	23.0	19,183	91.0
25	28.9	72.0	—	—	23,511	91.7
	29.4	—	37.4	31.0	23,918	91.7
30	35.6	95.0	—	—	28,742	92.4
	34.7	—	48.0	47.0	28,015	92.4
40	42.0	110.0	55.0	48.8	33,690	93.0

HIGH EFFICIENCY MOTORS					
Nominal Bhp	**Maximum Bhp**	**Maximum Amps**		**Maximum Watts**	**Maximum Efficiency**
		230 v	**460 v**		
5	5.9	15.8	7.9	4,918	89.5
7.5	8.7	22.0	—	7,078	91.7
	9.5	—	12.0	7,728	91.7
10	10.2	28.0	—	8,298	91.7
	11.8	—	15.0	9,600	91.7
15	15.3	43.8	—	12,273	93.0
	18.0		21.9	14,439	93.0
20	22.4	58.2	—	17,853	93.6
	23.4	—	28.7	18,650	93.6
25	28.9	73.0	—	23,034	93.6
	29.4	—	36.3	23,432	93.6
30	35.6	82.6	—	28,374	93.6
	34.7	—	41.7	27,656	93.6
40	42.0	110.0	55.0	33,156	94.5

LEGEND

Bhp — Brake Horsepower

NOTES:

1. Extensive motor and electrical testing on the Carrier units has ensured that the full horsepower range of the motor can be utilized with confidence. Using your fan motors up to the horsepower ratings shown in the Motor Limitations table will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
2. All motors comply with Energy Policy Act (EPACT) Standards effective October 24, 1997.

Table 34 — Air Quality Limits

UNIT 48AJ,AK,AW,AY	UNIT 48EJ,EK,EW,EY	MINIMUM HEATING AIRFLOW (Low Heat)	MINIMUM HEATING AIRFLOW (High Heat)	MINIMUM COOLING AIRFLOW (VAV) AT FULL LOAD OPERATION	MINIMUM COOLING AIRFLOW (CV	MAXIMUM AIRFLOW
020	**024**	5,900	6,100	4,000	6,000	10,000
025	**028**	5,900	6,100	5,000	7,500	12,500
027	**030**	5,900	6,100	5,400	8,100	13,500
030	**034**	5,900	6,100	6,000	9,000	15,000
035	**038**	7,600	10,100	7,000	10,500	17,500
040	**044**	7,600	10,100	8,000	12,000	20,000
—	**048**	7,600	10,100	9,000	13,500	22,500
050	**—**	7,600	10,100	10,000	15,000	22,500
—	**054**	11,000	14,700	10,000	15,000	25,000
—	**058**	11,000	14,700	11,000	16,500	27,000
060	**064**	11,000	14,700	12,000	18,000	27,000
—	**068**	11,000	14,700	13,000	19,500	27,000

LEGEND

CV — Constant Volume
edb — Entering Dry Bulb
ewb — Entering Wet Bulb
VAV — Variable Air Volume

NOTE: Variable Air Volume units will operate down to 70 cfm/ton in Cooling mode. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited to edb and ewb conditions.

Return-Air Filters — Check that correct filters are installed in filter tracks (see Tables 1A and 1B). Do not operate unit without return-air filters.

Filter Replacement — To replace filters, open filter access door (marked with label). Remove inner access panel. Remove plastic filter retainer in between filter tracks by sliding and pulling outward. Remove first filter by sliding it out of the opening in filter track. Locate filter removal tool, which is shipped next to the return air dampers. Use the filter removal tool to remove the rest of the filters.

Outdoor-Air Inlet Screens — Outdoor-air inlet screens must be in place before operating unit.

Economizer Adjustment — Remove filter access panel. Check that outdoor-air damper is closed and return-air damper is open.

Economizer operation and adjustment are described in Sequence of Operation section on this page; and Step 10 — Make Outdoor Air Inlet Adjustments section on page 48.

Gas Heat — Verify gas pressures before turning on heat as follows:

1. Turn off field-supplied manual gas stop, located external to unit.
2. Connect pressure gage to supply gas tap, located on field-supplied manual shutoff valve (see Fig. 23 on page 29).
3. Connect pressure gage to manifold pressure tap on unit gas valve.
4. Supply gas pressure must not exceed 13.5 in. wg. Check pressure at field-supplied shut-off valve.
5. Turn on manual gas stop and initiate a heating demand. Jumper R to W1 in the control box to initiate heat. On VAV units, the RAT (return-air temperature) must be less than or equal to 68 F for heating to be energized.
6. Use the field test procedure to verify heat operation.
7. After the unit has run for several minutes, verify that incoming pressure is 6.0 in. wg or greater, and that the manifold pressure is 3.5 in. wg. If manifold pressure must be adjusted refer to Gas Valve Adjustment section on page 93.

Sequence of Operation

NOTE: Unit is shipped with default values that can be changed through Service Tool, Building Supervisor, or ComfortWORKS® software or using an accessory Remote Enhanced Display. See Table 35 for default values.

COOLING, CONSTANT VOLUME (CV) UNITS — On power up, the control module will activate the initialization software of the control board. The initialization software then reads DIP switch no. 1 position to determine CV or VAV operation. Next, DIP switch no. 2 is read to determine if the control is thermostat or sensor type operation. If switch 2 is open, then sensors are employed. If switch no. 2 is closed, thermostat is employed. Initialization sequence clears all alarms and alerts, remaps the input/output database for CV operation, sets maximum heat stages to 2, and sets maximum cool stages to 3. The control module reads DIP switch no. 3 and determines if the unit will use expansion board operation.

The first time power is sent to the control board after a power outage, power up takes 5 minutes plus a random 1 to 63 seconds.

The TSTAT function performs a thermostat based control by monitoring Y1, Y2, W1, W2, and G inputs. These functions control stages cool1, cool2, heat1, heat2, and indoor fan, respectively. If TSTAT function is NOT selected, the control determines the occupancy state on the Time Schedules or with remote occupied/unoccupied input. If Temperature Compensated Start is active, the unit will be controlled as in the Occupied mode. User-defined set points are shown in Table 35.

Table 36 lists the software link points addressable by DataPort™ and DataLINK™, Carrier devices that allow access to unit control by non-Carrier energy management systems (EMS).

The occupied or unoccupied comfort set points must be selected and the space temperature offset input will be used, if present. The Occupied Heat set point default value is 68 F. The Occupied Cool set point default value is 78 F. The Unoccupied Heat set point default value is 55 F. The Unoccupied Cool set point value is 90 F. The control board will set appropriate operating mode and fan control. The control board will turn on indoor fan, if in Occupied mode, or determine if unit is in Unoccupied mode and the space temperature is outside of the unoccupied comfort set points, (Unoccupied Heat or Unoccupied Cool).

The control board will then monitor space temperature against comfort set points and control heating or cooling stages as required. If system is in the Occupied mode, the economizer will operate as required. If the system is in Unoccupied mode, the system will perform nighttime free cool and IAQ (indoor air quality) pre-occupancy purge as required (when functions are enabled via software). Whenever the DX (direct expansion) cooling is requested, the outdoor fan will operate.

The control board will operate economizer, run diagnostics to monitor alarms/alerts at all times, and respond to CCN communications to perform any configured network POC (product outboard control) functions such as time and outdoor-air temperature broadcast and Global occupancy broadcast. When the optional expansion I/O board is employed, it will: perform periodic scan and maintain database of expanded I/O points, perform Fire/Smoke control (power exhaust required); and if in Occupied mode perform IAQ control and monitor fan, filter, demand limit, and field-applied status (with accessories).

If thermostats are used to energize the G input, the control will turn on indoor fan without delay and open economizer dampers to minimum position. If thermostats are used to deenergize the G input, the control board will turn off indoor fan without any delay and close economizer dampers.

When cooling, G must be energized before cooling can operate. The control board determines if outdoor conditions are suitable for economizer cooling using the standard outdoor air thermistor. For economizer to function for free cooling, the enthalpy must be low, the outdoor air must equal to or less than the High Outdoor Air Temperature Lockout (default is 65 F), the SAT (supply-air temperature) thermistor is NOT in alarm, and outdoor air reading is available. When these conditions are satisfied, the control board will use economizer as the first stage of cooling.

When Y1 input is energized, the economizer will be modulated to maintain SAT at the defined set point. The default is 55 F. When SAT is above the set point, the economizer will be 100% open. When SAT is below the set point, the economizer will modulate between minimum and 100% open position. When Y2 is energized, the control module will turn on compressor no. 1 and continue to modulate economizer as described above. If the Y2 remains energized and the SAT reading remains above the set point for 15 minutes, compressor no. 2 will turn on. If Y2 is deenergized at any time, only the last stage of compression that was energized will be turned off. If outdoor conditions are not suitable for economizer cooling, the economizer will go to minimum position and cycle compressor no. 1 and 2 based on demand from Y1 and Y2 respectively. The compressors will be locked out when the SAT temperature is too low (less than 40 F for compressor no. 1 and less than 45 F for compressor no. 2.) After a compressor is locked out, it can restart after normal time guard period.

Table 35 — User Defined Set Points

SET POINT NAME	FORMAT	DESCRIPTION	LIMITS	DEFAULT
OHSP	xx.xF	Occupied Heat Set Point	55 to 80 F	68 F
OCSP	xx.xF	Occupied Cool Set Point	55 to 80 F	78 F
UHSP	xx.xF	Unoccupied Heat Set Point	35 to 80 F	55 F
UCSP	xx.xF	Unoccupied Cool Set Point	75 to 110 F	90 F
SASP	xx.xF	Supply Air Set Point	45 to 70 F	55 F
OATL	xx.xF	Hi OAT Lockout Temperature	55 to 75 F	65 F
NTLO	xx.xF	Unoccupied OAT Lockout Temperature	40 to 70 F	50 F
RTIO	xx.x	Reset Ratio	0 to 10	3
LIMT	xx.xF	Reset Limit	0 to 20° F	10° F
MDP	xxx%	Minimum Damper Position	0 to 100%	20%
LOWMDP	xxx%	Low Temperature Minimum Damper Position Override	0 to 100%	100%
IAQS	xxxx	IAQ Set Point	1 to 5000 PPM	650 PPM
UHDB	xx.xF	Unoccupied Heating Deadband	0 to 10° F	1° F
UCDB	xx.xF	Unoccupied Cooling Deadband	0 to 10° F	1° F
LTMP	xxx%	Low Temp. Min. Position	0 to 100%	10%
HTMP	xxx%	High Temp. Min. Position	0 to 100%	35%
PES1	xxx%	CV Power Exhaust Stage 1 Point	0 to 100%	25%
PES2	xxx%	CV Power Exhaust Stage 2 Point	0 to 100%	75%

LEGEND

CV — Constant Volume
IAQ — Indoor Air Quality
OAT — Outdoor-Air Temperature

Table 36 — Software Control Link Points

SET POINT	DESCRIPTION	SET POINT	DESCRIPTION
		CV Data	
SPT	Space Temperature	**HS2**	Heat Stage 2
SAT	Supply-Air Temperature	**STO**	Space Temp. Offset
RAT	Return-Air Temperature	**CVPE1**	CV Power Exhaust Stg 1
OAT	Outside-Air Temperature	**CVPE2**	CV Power Exhaust Stg 2
CLSP	Control Set Point	**VAV Data**	
CCAP	Cooling % Total Capacity	**HIR**	Heat Interlock Relay
HCAP	Heating % Total Capacity	**SPTRESET**	Space Temp. Reset
ECOS	Economizer Active	**CMP1**	Compressor 1
SFSTAT	Supply Fan Status	**CMP1SAFE**	Compressor 1 Safety
SF	Fan Relay	**CMP2**	Compressor 2
ECONPOS	Economizer Position	**CMP2SAFE**	Compressor 2 Safety
IQMP	Min. Damper Position	**ULD1**	Unloader 1
PEXE	Power Exhaust Enable	**ULD2**	Unloader 2
FLTS	Filter Status	**OFC1**	Outdoor Fan 1
FAS	Field Applied Status	**OFC2**	Outdoor Fan 2
RMTOCC	Remote Occupied Mode	**Y1**	Y1 — Call for Cool 1
General Data		**Y2**	Y2 — Call for Cool 2
HS1	Heat Stage 1	**W1**	W1 — Call for Heat 1
ENTH	Enthalpy	**W2**	W2 — Call for Heat 2
IAQI	Indoor Air Quality	**G**	G — Call for Fan
IAQO	Outdoor Air Quality	**CDEVCODE**	CONQUEST DEVICE CODE
SATRES	SAT Reset	**CDEVURST**	CONQUEST UNIT RESET
ALMLIGHT	Alarm Warning Light	**CDEVBCAK**	CONQUEST BROADCAST ACK
DL	Demand Limit Switch	**PE1**	Mod. Power Exhaust Stg 1
EVAC	Evacuation	**PE2**	Mod. Power Exhaust Stg 2
PRES	Pressurization	**PE3**	Mod. Power Exhaust Stg 3
PURG	Smoke Purge	**PE4**	Mod. Power Exhaust Stg 4
FSD	Fire Shutdown	**PE5**	Mod. Power Exhaust Stg 5
		PE6	Mod. Power Exhaust Stg 6

LEGEND

CV — Constant Volume
VAV — Variable Air Volume

The Time Guard® function maintains a minimum off time of 5 minutes, a minimum ON time of 10 seconds, and a minimum delay before starting the second compressor of 10 seconds.

If the compressors have been off for more than 15 minutes and the OAT (outdoor-air temperature) is less than 45 F, then the safeties will be ignored for 5 minutes. At all times, safeties will be used.

Heating and cooling will be mutually locked out on demand on a first call basis. The heating and the cooling functions cannot be operating simultaneously.

COOLING, VARIABLE AIR VOLUME (VAV) UNITS — On power up, the control module will activate the initialization software of the control board. The initialization software then reads DIP switch no. 1 position to determine CV or VAV operation. Initialization clears all alarms and alerts, re-maps the input/output database for VAV operation, sets maximum heat stages to 1 and sets maximum cool stages to 6. The control module reads DIP switch no. 3 and determines if the unit will use expansion board operation. Power up takes a random time of 1 to 63 seconds plus 5 minutes the first time power is sent to the control board after a power outage.

The control module will determine if an interface (linkage) is active and if the unit will operate in a Digital Air Volume (DAV) mode. In a DAV system, the room terminals are equipped with microprocessor controls that give commands to the base unit module. If an interface is active, the control will replace local comfort set points, space and return air temperatures and occupancy status with the linkage data supplied.

The control module will determine occupancy status from Time Schedules (if programmed), Remote Occupied/Unoccupied input, global occupancy, or DAV. If Temperature Compensated Start is active, the unit will be controlled as in the Occupied mode.

NOTE: The temperature compensated start is a period of time calculated to bring the unit on while in Unoccupied mode to reach the occupied set point when occupancy occurs.

The control module will set the appropriate operating mode and fan control. The control module will turn VFD on if Occupied mode is evident.

For units equipped with a start/stop switch only (no space temperature sensor), if in Unoccupied mode and valid return-air temperature reading is available (either from a sensor or DAV), the control will monitor return-air temperature against Unoccupied Heat and Cool set points.

For units with a start/stop switch and a space temperature sensor, the control module will start the VFD whenever SPT is outside of the set points (Unoccupied Heat or Unoccupied Cool). The VFD may also be started by nighttime thermostat via remote Occupied/Unoccupied input or by a Temperature Compensated Start algorithm. When VFD is running in a normal mode, the control will start heating or cooling as required to maintain supply-air temperature at the supply air set point (SASP) plus the reset (when enabled). The reset value is determined by SAT (supply-air temperature) reset and/or space temperature reset algorithms. The space temperature reset is only available when enabled through software.

When cooling, the control will energize the power exhaust enable output to the external power exhaust controller, when power exhaust is used.

If in Occupied mode, the control module will perform economizer control (economizer control same as described above for CV units). If in Unoccupied mode, the control module will perform nighttime free cool and IAQ pre-occupancy purge as required (when enabled through software). When DX (direct expansion) cooling is called, the outdoor fans will always operate.

The control will run continuous diagnostics for alarms/alerts; respond to CCN communications and perform any configured network POC (product outboard controls) functions such as time and outdoor-air temperature broadcast and global broadcast; and perform Fire/Smoke control if equipped with power exhaust.

GAS HEATING, CONSTANT VOLUME (CV) UNITS — The gas heat units incorporate 2 (48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048) or 3 (48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068) separate systems to provide gas heat. Each system incorporates its own induced-draft motor, Integrated Gas Control (IGC) board, 2 stage gas valve, manifold, etc. The systems are operated in parallel; for example, when there is a call for first stage heat, all induced-draft motors operate, all gas valves are energized, and both IGC boards initiate spark.

All of the gas heating control is performed through the IGC boards (located in the heating section). The control module board serves only to initiate and terminate heating operation.

The control module board is powered by 24 vac. When the thermostat or room sensor calls for heating, power is sent from the control module board to W on each of the IGC boards. An LED on the IGC board will be on during normal operation. A check is made to ensure that the rollout switches and limit switches are closed and the induced-draft motors are not running. The induced-draft motors are then energized, and when speed is proven with the hall effect sensor on the motor, the ignition activation period begins. The burners will ignite within 5 seconds.

When ignition occurs the IGC board will continue to monitor the condition of the rollout and limit switches, the hall effect sensor, as well as the flame sensor. If the unit is controlled through a room thermostat set for fan auto., 45 seconds after ignition occurs, the indoor-fan motor will be energized and the outdoor-air dampers will open to their minimum position. If for some reason the overtemperature limit opens prior to the start of the indoor fan blower, on the next attempt, the 45-second delay will be shortened to 5 seconds less than the time from initiation of heat to when the limit tripped. Gas will not be interrupted to the burners and heating will continue. Once modified, the fan on delay will not change back to 45 seconds unless power is reset to the control. If the unit is controlled through a room sensor, the indoor fan will be operating in the Occupied mode and the outdoor-air dampers will be in the minimum position.

If the unit is controlled with a room sensor in the Unoccupied mode, the indoor fan will be energized through the IGC board with a 45-second delay and the outside-air dampers will move to the IAQ position (generally set to zero in the Unoccupied mode). The IAQ feature is enabled through system software. If IAQ is not enabled, dampers will move to the minimum position.

When additional heat is required, W2 closes and initiates power to the second stage of the main gas valves. When the thermostat is satisfied, W1 and W2 open and the gas valves close interrupting the flow of gas to the main burners. If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active. If the unit is controlled through a room thermostat set for fan auto., the indoor-fan motor will continue to operate for an additional 45 seconds then stop and the outdoor-air dampers will close. If the overtemperature limit opens after the indoor motor is stopped within 10 minutes of W1 becoming inactive, on the next cycle the time will be extended by 15 seconds. The maximum delay is 3 minutes. Once modified, the fan off delay will not change back to 45 seconds unless power is reset to the control. If the unit is controlled through a room sensor, the indoor fan will be operating in the Occupied mode and turned off after 45 seconds in the Unoccupied mode.

GAS HEATING, VARIABLE AIR VOLUME (VAV) UNITS — All of the gas heating control is performed through the integrated gas control (IGC) board. The control module board serves only to initiate and terminate heating operation.

NOTE: The unit is factory-configured for disabled occupied heating. DIP switch 5 is used to enable occupied heating (DIP switch 5 set to OPEN).

Variable Air Volume (VAV) occupied heat is controlled by return-air temperature (RAT) using a 5k thermistor located just below the outdoor-air dampers. A VAV unit without a space temperature sensor is also controlled by RAT. A VAV unit with a space temperature sensor has Unoccupied Heat controlled by space temperature (SPT).

The control module board is powered by 24 vac. When there is a call for heating (either Morning Warm-Up, Unoccupied, or Occupied modes), power is sent from the control module board to W on each of the IGC boards and W2 of the main gas valve. When heating, the control module board will energize a field-supplied heat interlock relay output to drive the VAV terminal boxes wide open. The HIR is not required on a DAV system. See Fig. 59. In the Occupied mode the indoor-fan motor will be operating and the outdoor-air dampers will be in the minimum position. In the Unoccupied mode the indoor-fan motor will be off, but will energize 45 seconds after the call for heat and the outdoor-air dampers will move to the IAQ Unoccupied position (generally set to zero in the Unoccupied mode). The duct pressure sensor will signal to the variable frequency drive to operate at full speed since all terminals have been driven open. An LED on the IGC board will be on during normal operation. A check is made to ensure that the rollout switches and limit switches are closed and the induced-draft motors are not running. The induced-draft motors are then energized and when speed is proven with the hall effect sensor on the motor, the ignition activation period begins. The burners will ignite within 5 seconds.

When ignition occurs the IGC board will continue to monitor the condition of the rollout and limit switches, the hall effect sensor, and the flame sensor.

If the call for heat lasted less than 1 minute, the heating cycle will not terminate until 1 minute after heat became active. When heating is satisfied, the power will be interrupted to the IGC board and W1 and W2 of the main gas valve. If the unit is controlled through a room sensor, the indoor fan will be operating in the Occupied mode and turned off after 45 seconds in the Unoccupied mode.

STAGED GAS UNIT HEATING — The Staged Gas Control option offered on 48EJ,EK,EW,EY024-068 and 48AJ,AK,AW, AY020-060 units adds the capability to control the rooftop unit's gas heating system to a specified Supply Air Temperature Set Point for purposes of tempering a cool mixed-air condition. The gas heating system employs multiple heating sections. Each section is equipped with a two-stage gas valve. The gas valves are sequenced by a factory-installed staged gas controller (SGC) as required to maintain the user-specified Supply Air Set Point. Up to eleven stages of heating control are available, based on quantity and heating capacity sizes of the individual heat exchanger sections provided in the base unit. In addition to providing system control for tempering heat operation, the new SGC also controls Demand Heat sequences for both First-Stage (W1) and Second-Stage (W2 or full-fire) operation.

Tempering of supply air is desirable when rooftop units are operating in ventilation mode (economizer only operation) at low outdoor temperatures. At low outdoor temperatures, the mixed air temperature (combination of return-from-space temperature and outdoor/ventilation air temperature) may become too low for the comfort of the occupants or for the terminal reheat systems. The tempering function adds incremental steps of heat capacity to raise the temperature of the mixed air up to levels suitable for direct admission into the occupied space or to levels consistent with reheat capabilities of the space terminals. Refer to Table 37 for the staged gas heating control system components. Refer to Table 38 for the heating system controller (SGC) inputs. The heating system controller (SGC) outputs consist of six relays (K1 through K6) which control the individual gas valves.

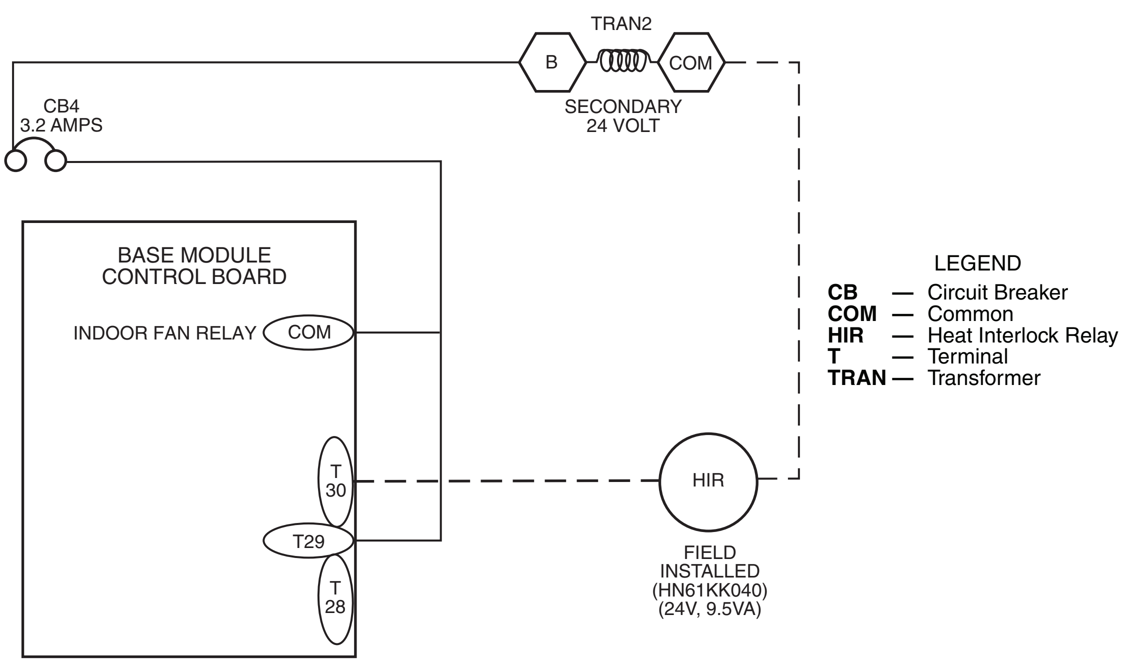


Fig. 59 — Heat Interlock Relay Wiring

Table 37 — Staged Gas System Components

ITEM	FUNCTION	LOCATION
Heating Controller (SGC)	Logic and Output Relays	Heating section
Supply-Air Thermistors (SAT)	Sense unit leaving-air temperature	Supply duct (factory-provided, field-installed)
Cooling Supply Air Set Point Potentiometer (CLSASP)	Specify set point for tempering heat control Set Point Range: 35 to 70 F	Heating section, next to SGC
Heating Supply Air Set Point Potentiometer (HTSASP)	Specify set point for First-Stage Heating control Set Point Range: 80 to 125 F	Heating section, next to SGC
Air Flow Switch (AFS)	Prove Supply Fan operation	Fan supply air plenum (factory-installed)

Table 38 — Stage Gas System Inputs/Outputs

INPUT	DESCRIPTION
Cool1	Relay in parallel with Compressor #1 contactor
Cool2	Relay in parallel with Compressor #2 contactor
Heat1	24V input from Base Unit control
Heat2	24V input from Base Unit control
Fan	Air proving switch (contact closure on rise in static pressure)
Cool Supply Set Point	Potentiometer, (range 35-70 F)
Heat Supply Set Point	Potentiometer, (range 80-125 F)
Supply Air Thermistor (1, 2 and 3)	Field-installed in supply ductwork (P/N HH79NZ016)

Operating Modes — The SGC will operate the unit in one of the following operating modes:

- no mode
- Cooling Mode
- Heating1 Mode
- Heating2 Mode

No Mode — In this mode, none of the heat stages are turned on. No mode occurs if the Cool, Heat or Fan inputs are off or the Cool input(s) are on.

Tempering (Cool) Mode — In this mode, the SGC tempers in incoming supply air to maintain the cooling supply air set point. Tempering mode occurs if the Fan input is ON and all Cool and Heat inputs are off.

When the SGC determines that the fan is on and the base unit control is not calling for heat or mechanical cooling, the SGC will stage heat to maintain the cooling set point which is set on the CLSASP potentiometer of the SGC. This set point should be slightly below the supply air set point of the base unit VAV control. Note that the supply-air temperature will still be in the "cooling range."

Heat1 Mode — Heat1 mode is used on VAV applications as they have one heat stage on the base unit control. CV units have two heat stages and will not operate under Heat1 mode.

In this mode, heat is staged to control supply air temperature to HTSASP. Heat1 mode occurs only if Heat1 is ON and Heat2 is OFF and Cool1 and Cool2 are OFF.

When the base unit control calls for first stage of heat, the SGC will stage heat to maintain the heating set point set on the potentiometer of the SGC. The HIR will be energized to command the zone terminals to open to maintain minimum heating airflow.

Heat2 Mode — Heat2 mode is used on CV applications as they have 2 heat stages on the base unit control. VAV units have only 1 heat stage and will not operate under Heat2 mode.

In this mode, when the base unit calls for the second stage of heat, the SGC will turn on all available heat stages. This mode only occurs if Heat1 and Heat2 are ON and Cool1 and Cool2 are OFF.

Accessory Navigator Display — The Navigator Display is a field-installed accessory. See Fig. 60. Navigator Display is to be connected to LEN connections at communication board which is attached to the heating and cooling supply air set point potentiometers in heating section. The Navigator Display accessory is required for all units with staged gas control.

The display module provides the user interface to the *Staged Gas* control system. See Fig. 60. The display has up and down arrow keys, an ESCAPE key, and an ENTER key. These keys are used to navigate through the different levels of the display structure. See Table 39. Press the ESCAPE key until the display is blank to move through the top 11 mode levels indicated by LEDs on the bottom left side of the display.

Pressing the ESCAPE and ENTER keys simultaneously will scroll a text description across the display indicating the full meaning of each display acronym. Pressing the ESCAPE and ENTER keys when the display is blank (Mode LED level) will return the display to its default menu of rotating display items. In addition, the password will be disabled requiring that it be entered again before changes can be made to password protected items.

When a specific item is located, the display will flash showing the operator, the item, item value, and then the item units (if any). Press the ENTER key to stop the display at the item value. Items in the Configuration and Service Test modes are password protected. The display will flash PASS and WORD when required. Use the ENTER and arrow keys to enter the 4 digits of the password. The default password is 1111.

Changing item values or testing outputs is accomplished in the same manner. Locate and display the desired item. Press the ENTER key to stop the display at the item value. Press the ENTER key again so that the item value flashes. Use the arrow keys to change the value or state of an item and press the ENTER key to accept it. Press the ESCAPE key and the item, value, or units display will resume. Repeat the process as required for other items.

The unit alarms can be cleared through Navigator display. To check the current alarms, enter the Alarms menu. The first submenu is the CRNT submenu. The CRNT function displays the list of current alarms (maximum of 25). The second submenu item is the RCRN (Reset All Current Alarms) function. Press ENTER to reset the current alarms. The next submenu item, HIST, displays the list of cleared alarms (maximum of 20). The HIST function can be cleared with the RHIS function.

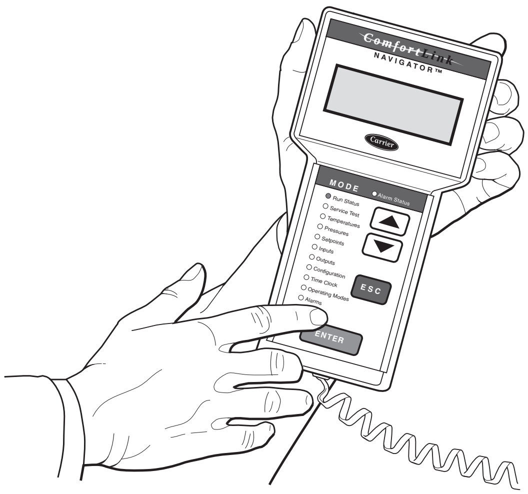


Fig. 60 — Navigator Display

MORNING WARM-UP (VAV only with PC Accessed/CCN Operation) — Morning warm-up occurs when the control has been programmed to turn on heat prior to the Occupied mode to be ready for occupancy mode. Morning warm-up is a condition in VAV systems that occurs when the Temperature Compensated Start algorithm calculates a biased occupied start time and the unit has a demand for heating. The warm-up will continue into the occupied period as long as there is a need for heat. During warm-up, the unit can continue heating into the occupied period, even if occupied heating is disabled. When the heating demand is satisfied, the warm-up condition will terminate. To increase or decrease the heating demand, use Service Tool software to change the Occupied Heating set point.

NOTE: To utilize Morning Warm-Up mode, the unit occupancy schedule must be accessed via Service Tool, Building Supervisor, or ComfortWORKS® software or accessory Remote Enhanced Display. The PC can access the base control board via the 3-wire communication bus or via an RJ-11 connection to the CCN terminal on the base control board. See Fig. 27.

For current software (version 3.0 or later), the Low Temperature Minimum Damper Position Override (LOWMDP) has a 0 to 100% limit, with a default of 100%. Think of the LOWMDP as a second minimum damper position. This LOWMDP limit change requires access to the unit software with a computer equipped with Building Supervisor, Service Tool, or ComfortWORKS Software.

When the LOWMDP is in effect the outdoor dampers will remain at the LOWMDP position (typically set to 0% closed) during heating, even in the Occupied period. For the LOWMDP to be in effect the LOWMDP must be less than the minimum damper position (MDP) and the RAT (return-air temperature) must be less than the OHSP (occupied heat set point) minus 2.5° F. Table 40 summarizes the operational requirements and controlling factors for occupied heat and morning warm-up.

MORNING WARM-UP (VAV Only with Stand-Alone Operation) — When the unit operates in stand-alone mode, morning warm-up occurs when the unit is energized in Occupied mode and return-air temperature (RAT) is below 68 F. Warm-up will not terminate until the RAT reaches 68 F. The heat interlock relay output is energized during morning warm-up. (A field-installed 24-vdc heat interlock relay is required.) The output will be energized until the morning warm-up cycle is complete. Refer to Fig. 59 for heat interlock relay wiring.

Table 39 — Navigator Display Menu Structure

RUN STATUS	SERVICE TEST	TEMPERATURES	PRESSURES	SET POINTS	INPUTS	OUTPUTS	CONFIGURATION	TIME CLOCK	OPERATING MODES	ALARMS
Auto Display (VIEW)	SERVICE TEST	SUPPLY AIR TEMPERATURE	N/A	SETPOINT SELECT	COOL INPUT#1	HEAT OUTPUT 1	Display Configuration (DISP)	Time (TIME)	N/A	Currently Active Alarms (CRNT)
Software Version (VERS)	HEAT OUTPUT#1	SUPPLY AIR TEMPERATURE 1	N/A	COOLING SETPOINT 1	COOL INPUT#2	HEAT OUTPUT 2	CCN Configuration (CCN)	Date (DATE)	N/A	Reset all Current Alarms (RCRN)
	HEAT OUTPUT#2	SUPPLY AIR TEMPERATURE 2	N/A	COOLING SETPOINT 2	HEAT INPUT#1	HEAT OUTPUT 3	Stage Gas Configuration (CNFG)	Occupancy and Unoccupancy Schedule Number (SCHD)		Alarm History (HIST)
	HEAT OUTPUT#3	SUPPLY AIR TEMPERATURE 3		HEATING SETPOINT 1	HEAT INPUT#1	HEAT OUTPUT 4				Reset Alarm History (RHIS)
	HEAT OUTPUT#4			HEATING SETPOINT 2	SUPPLY FAN STATUS	HEAT OUTPUT 5				
	HEAT OUTPUT#5					HEAT OUTPUT 6				
	HEAT OUTPUT#6									

Table 40 — Occupied Heat and Morning Warm-Up Operation and Controlling Factors

SOFTWARE VERSION	OCCUPIED HEAT ENABLED VIA	MORNING WARM-UP MAY START DURING	TEMPERATURE CONDITION FOR HEAT TO START
3.0 and Later	DIP switch no. 5	Smart start or within 10 minutes	RAT < OHSP

LEGEND

OHSP — Occupied Heat Set Point
RAT — Return-Air Temperature

SPACE TEMPERATURE SENSOR CONTROL — If the unit is equipped with a field-supplied space sensor and a remote start/stop switch, constant volume (CV) cooling will operate as follows: Stage 1 cooling begins when there exists a 1.5° F demand and ends when the demand returns back to 0.5° F. Stage 2 cooling begins when there is a 2.0° F demand and will continue until the demand returns 1.0° F. Stage 2 cannot be energized until a minimum of eight minutes of Stage 1 operation or as long as stage 1 is making a reduction in the space temperature trend. If the temperature trends stop improving but the demand still exceeds 2.0° F, then Stage 2 cooling will be energized.

When economizer operation is suitable, the control will use economizer, as the first stage of cooling will bring on the compressor 1 when Stage 2 demand is called for. If supply-air temperature (SAT) remains above supply-air set point (SASP) for 15 minutes after energizing compressor 1, then compressor 2 shall be started. When Stage 2 is satisfied, the last stage of compression shall be dropped. When Stage 1 is satisfied, the control will drop all DX cooling.

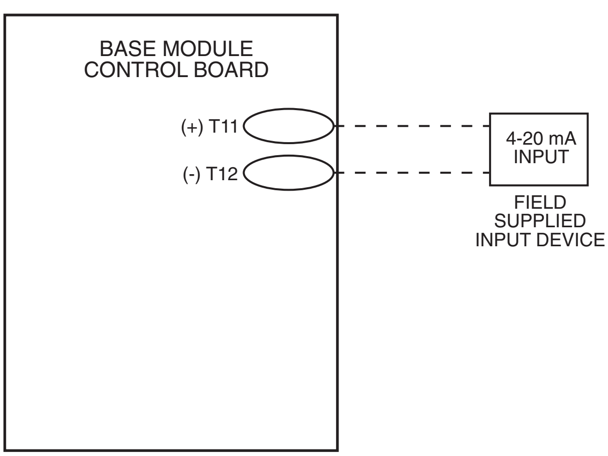
If the unit is equipped with a field-supplied space sensor and a remote start/stop switch, CV heating will operate as follows: Stage 1 heating begins when there exists 1.5° F demand and ends when the demand returns back to 0.5° F. Stage 2 heating begins when there is a 2.0° F demand and will continue until the demand returns to 1.0° F. Stage 2 cannot be energized until a minimum of eight minutes of Stage 1 operation or as long as Stage 1 is making an increase in the space temperature trend. If the temperature trends stop improving but the demand still exceeds 2.0° F, then Stage 2 heating will be energized

SPACE TEMPERATURE RESET SENSOR (VAV Only) — An accessory space temperature sensor (T-55 or T-56 without offset) is required. Space temperature reset is used to reset the supply-air temperature set point of a VAV system higher, as the space temperature falls below the Occupied Cool set point. As the space temperature falls below the Occupied Cool set point, the supply-air temperature will be reset upward as a function of the reset ratio. (Default is 3.) Reset ratio is expressed in degrees change in supply-air temperature per degree of space temperature change. A reset limit will exist which will limit the maximum number of degrees the supply-air temperature may be raised. (Default is 10 F.) Both the reset ratio and the reset limit are user definable. The sequence of operation is as follows:

1. The on/off status of the unit supply fan is determined.
2. If the fan is "on," the sequence will check if the system is occupied.
3. If the system is in Occupied mode, the sequence will determine if the reset option is enabled.
4. If the reset option is enabled, the sequence will read the space temperature and compare it to the Occupied Cool set point. If the temperature is below the Occupied Cool set point, the algorithm will compute the reset value and compare this value against the reset limit. If it is greater than the reset limit, the sequence will use the reset limit as the reset value. See Fig. 61.

NOTE: A computer equipped with Carrier network access software (ComfortWORKS®, Building Supervisor, or Service Tool) or an accessory Remote Enhanced Display is required to enable this function.

Space Temperature Reset Example — The occupied cooling set point is set to 73 F. The Reset Ratio is set to 5. The Reset Limit is set to 20 F. The Reset Ratio determines how many degrees F the temperature is reset. At 72 F, the supply temperature will be reset 5 degrees higher. At 71 F, the supply temperature will be reset 10 degrees higher. At 70 F, the supply temperature will be reset 15 degrees higher. At 69 F, the supply temperature will be reset 20 degrees higher and the Reset Limit will have been reached.



LEGEND

T — Terminal

NOTE: The 4 to 20 mA input is a field-supplied non-Carrier EMS (Energy Management System) device.

mA INPUT	DEG. F RESET
4	0.00
5	1.25
6	2.50
7	3.75
8	5.00
9	6.25
10	7.50
11	8.75
12	10.00
13	11.25
14	12.50
15	13.75
16	15.00
17	16.25
18	17.50
19	18.75
20	20.00

Fig. 61 — Space Temperature Reset Wiring

SUPPLY AIR TEMPERATURE RESET — Supply air temperature reset is used to reset the supply-air temperature utility. A 4 to 20 mA signal (field-supplied) is required. The reset option does not require enabling.

POWER EXHAUST OPERATION — Power exhaust has two options (constant volume and modulating) that have the following sequence of operation:

The constant volume power exhaust stage 1 (CVPE1) is enabled when the indoor fan has been energized and the desired outdoor-air damper position for the economizer increases above the first constant volume (CV) power exhaust stage 1 point (PES1). The PES1 factory default value is set at 25%. The constant volume power exhaust stage 2 (CVPE2) is enabled when the desired outdoor-air damper position for the economizer increases above the second CV power exhaust stage 2 point (PES2). The PES2 factory default value is set at 75%. Each stage is disabled when the desired damper position decreases below the respective set points.

The modulating power exhaust is enabled when the indoor fan is energized and the building pressure has exceeded the individual sequencer set points. The default set points are 0.04 in. wg (6.3 vdc) for stage 1, 0.10 in wg (6.8 vdc) for stage 2, 0.16 in wg (7.3 vdc) for stage 3, and 0.23 in. wg (7.8 vdc) for stage 4, 0.29 in. wg (8.3 vdc) for stage 5, and 0.35 in. wg (8.8 vdc) for stage 6 power exhaust sequencer. Each stage also requires that the building pressure is reduced until it drops below the disable set point. The default set points are 0 in wg. (6.0 vdc) for stage 1, 0.060 in. wg (6.5 vdc) for stage 2, 0.13 in. wg (7.0 vdc) for stage 3, 0.19 in. wg (7.4 vdc) for stage 4, 0.25 in. wg (8.0 vdc) for stage 5, and 0.31 in. wg (8.5 vdc) for stage 6 power exhaust sequencer. Both of these set points are changed at the specific controlling sequencer. It is not forcible from CCN.

If the indoor fan is on, then PEXE = ON. If the indoor fan is off, then PEXE = OFF. In addition, on units equipped with the Expansion I/O module, the control module board may have direct access 4 to 6 Modulated Power Exhausted stages bypassing an external sequencer device. These stages will be controlled directly in fire/smoke modes.

SMOKE CONTROL MODES — The 48AJ,AK,AW,AY and 48EJ,EK,EW,EY units with an optional expansion board perform fire and smoke control modes. The expansion board provides 4 modes which can be used to control smoke within the conditioned area. The modes of operation are fire shutdown, pressurization, evacuation, and smoke purge. See Table 41.

SMOKE DETECTOR — A smoke detector can be used to initiate fire shutdown. This can be accomplished by a set of normally closed pilot relay contacts which will interrupt power from the 24-v transformer, secondary "B" terminal to the control circuit breaker (CB4). See Fig. 62. The wire that connects these two points is white and labeled "W78."

NOTE: On standard gas models, the indoor fan will continue to run 45 seconds after the call for heat has been terminated. If fire shutdown is initiated the fan will stop immediately. No 45-second delay will occur.

The smoke detector may be mounted in the return air duct or the supply duct. Carrier does not make recommendations as to specific smoke detector location due to liability considerations.

INDOOR AIR QUALITY (IAQ) CONTROL — The accessory IAQ sensor is required for IAQ control on the base control board. The Carrier sensors operate with a 4 to 20 mA signal. The 4 to 20 mA signal is connect to T13 (+) and T14 (-) on the base control board for the IAQ sensor, and T15 (+) and T16 (-) on the base control board for the OAQ (Outdoor Air Quality) sensor. The sensor is field-mounted and wired to the base control board installed in the unit main control box. The IAQ sensor must be powered by a field-supplied 24-V power supply (ungrounded). Do not use the unit 24-V power supply to power sensor.

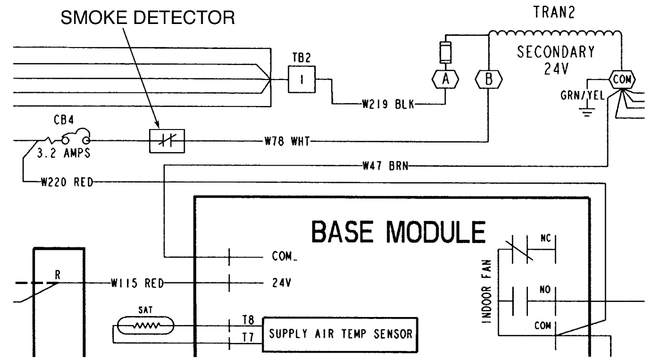


Fig. 62 — Field-Supplied Smoke Detector Wiring

NOTE: The Carrier IAQ/OAQ sensors are shipped configured for a 0 to 10 Vdc signal for use on previously designed PIC (Product Integrated Control) products. This signal must be changed to the 4 to 20 mA signal to be used on these products, which is accomplished through a jumper change. The IAQ/OAQ input signals are also polarized, with (+) connecting to the odd numbered terminals and (-) connected to the even numbered terminals. Refer to Indoor-Air Quality Section in the Controls, Operation, and Troubleshooting Manual for further sequence of operation.

NOTE: The IAQ Control function was incorporated onto the base control board on these units with serial number of 0600F and later.

Once installed, the sensor must be enabled. The sensor is configured with default values which may be changed through network access software. To work properly, the IAQ sensor high and low reference points for the sensor that is used must match the configured values. The base control board reacts to a 4 to 20 mA signal from the IAQ sensor. The low reference (4 mA output) must be configured to the minimum IAQ sensor reading. The high reference (20 mA output) must be configured to the maximum IAQ sensor reading.

The IAQ sensor can be configured to either low or high priority. The priority value can be changed by the user. The default is low.

Low priority — When the priority is set to low, the initial control is to the IAQ set point, but the outside air damper position will change to its minimum position when the following conditions occur:

- CV units with sensor — when the space temperature is greater than the occupied cooling set point plus 2° F or when the space temperature is less than the occupied heating set point minus 2° F.
- VAV units and CV units with thermostat — when the supply-air temperature is less than the supply-air temperature set point minus 8° F or when the supply-air temperature is greater than the supply air temperature set point plus 5° F for 4 minutes.
- When the outdoor air quality is greater than the outdoor air quality set point (ppm)

High priority — When the priority is set to high, the IAQ set point controls the outside air damper exclusively, with no regard to comfort conditioning.

TIME GUARD® CIRCUIT — The Time Guard function (built into the rooftop control module board) maintains a minimum off time of 5 minutes, a minimum on time of 10 seconds, and a 10-second delay between compressor starts.

CRANKCASE HEATER — Unit main power supply must remain on to provide crankcase heater operation. The crankcase heater in each compressor keeps oil free of refrigerant while compressor is off.

Table 41 — Smoke Control Modes

DEVICE	PRESSURIZATION	SMOKE PURGE	EVACUATION	FIRE SHUTDOWN
Economizer	100%	100%	100%	0%
Indoor Fan/VFD	ON	ON	OFF	OFF
Power Exhaust (all outputs)	OFF	ON	ON	OFF
Heat Stages	OFF	OFF	OFF	OFF
Cool Stages	OFF	OFF	OFF	OFF
HIR	ON	ON	OFF	OFF

LEGEND

HIR — Heat Interlock Relay
VFD — Variable Frequency Drive

HEAD PRESSURE CONTROL — Each unit has a fan cycling, outdoor thermostat to shut off the outdoor-fan motor(s) at 55 F (one outdoor-fan motor on 48AJ,AK,AW,AY020-030 and 48EJ,EK,EW,EY024-034 units, 2 outdoor-fan motors on 48AJ,AK,AW,AY035-050 and 48EJ,EK,EW,EY038-048 units and 3 outdoor-fan motors on 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 units). The head pressure control permits unit to operate with correct condensing temperatures down to 35 F outdoor-air temperature.

MOTORMASTER® III CONTROL — The Motormaster III Solid-State Head Pressure Control is a field-installed accessory fan speed control device actuated by a temperature sensor. It is specifically designed for use on Carrier equipment and controls the condenser-fan motor speed in response to the saturated condensing temperature. For outdoor temperatures down to –20 F, it maintains condensing temperature at 100 F. Refer to the accessory Motormaster installation instructions for more information.

CAPACITY CONTROL, COOLING — The cooling capacity staging tables are shown in Tables 42 and 43.

Table 42 — Cooling Capacity Staging Table, CV Units with 2 Compressors

	Stages			
	0	1 Economizer	2	3
Compressor 1	off	off	on	on
Compressor 2	off	off	off	on

NOTE: On CV units that require additional unloading, add suction pressure unloaders to Compressor 1 only.

Table 43 — Cooling Capacity Staging Table VAV Units with 2 Compressors and 2 Unloaders*

	STAGES						
	0	1	2	3	4	5	6
Compressor 1	off	on	on	on	on	on	on
Unloader 1	off	on	on	off	on	on	off
Unloader 2	off	on	off	off	on	off	off
Compressor 2	off	off	off	off	on	on	on

*40 ton units have only one unloader.

It is often desirable to use a variable air volume (VAV) unit in a variable volume and temperature (VVT) control system because of the greater unloading capability. A VAV unit (with software version 4.0 and later) can easily be configured in the field to run off of either space thermostat (VVT® relay pack) input or a space sensor. When configured in this manner, the unit control will turn on compressors based upon load in the space. If the supply-air falls below predefined limits, the control will unload the compressor in order to maintain the minimum supply-air limit. If unloading is not successful in maintaining the minimum supply-air temperature (SAT), then the compressors will be turned off. An alarm will be issued when the compressors are turned off.

A VAV unit configured to run off thermostat input or a space sensor will have the capability for two stages of heating, however, modification to the control wiring will be required to make this available. The Variable Frequency Drive (VFD) for the supply fan will still be active, varying the supply air fan speed to maintain supply duct pressure.

Upon a call for Y1 (or Y2_SPT) cooling, the compressor 1 will start after appropriate Time Guard® functions. Thirty seconds after the SAT drops below the "SAT1TRIP" the compressor will be unloaded. The unloading sequence will be as follows:

Compressor no. 1 On, Full Load	Unloader no. 1 and no. 2 Off
Compressor no. 1 On, 2/3 Load	Unloader no. 1 Off, Unloader no. 2 On
Compressor no. 1 On, 1/3 Load	Unloader no. 1 and no. 2 On
Compressor no. 1 Off	Unloader no. 1 and no. 2 Off

The "Y1 Low SAT Limit" has an adjustable range from 50 F to 65 F, with a factory setting of 53 F. If the temperature of the SAT rise above the "Y1 Low SAT Limit" plus 2° F, the compressor will be loaded in the reverse order in which it was unloaded following the pre-described time guards. There will be a 90-second time guard between any change in unloaded state, and the normal 5-minute time guard for change in compressor On/Off state.

If compressor no. 1 is forced off due to "Y1 LOW SAT Limit" an alert will be issued. If economizer is suitable, the economizer mode will remain active. The alert will be cleared after the 5-minute time guard has expired and the compressor is restarted. With Y1 (or Y1_SPT) input, only compressor no. 1 can be running.

Upon a call for Y1 (or Y1_SPT) and Y2 (or Y2_SPT) cooling both compressor no. 1 and 2 will start after appropriate time guards. Thirty seconds after SAT drops below the "Y2 Low SAT Limit" the compressor will be unloaded. The unloading sequence will be as follows:

Compressor no. 1 On, Full Load	Unloader no. 1 and no. 2 Off	Compressor no. 2 On
Compressor no. 1 On, 2/3 Load	Unloader no. 1 Off, Unloader no. 2 On	Compressor no. 2 On
Compressor no. 1 On, 1/3 Load	Unloader no. 1 and no. 2 On	Compressor no. 2 On
Compressor no. 1 On, Full Load	Unloader no. 1 and no. 2 Off	Compressor no. 2 Off
Compressor no. 1 On, 2/3 Load	Unloader no. 1 Off, Unloader no. 2 On	Compressor no. 2 Off
Compressor no. 1 On, 1/3 Load	Unloader no. 1 and no. 2 On	Compressor no. 2 Off
Compressor no. 1 Off	Unloader no. 1 and no. 2 Off	Compressor no. 2 Off

The "Y2 Low SAT Limit" has an adjustable range from 45 F to 55 F, with a factory default setting of 48 F. If the temperature of the SAT rise above the "Y2 Low SAT Limit" plus 2° F, the compressor will be loaded in the reverse order in which it was unloaded following the pre-described Time Guard functions. There will be a 90-second time guard between any change in unloaded state, and the normal 5-minute time guard for change in compressor On/Off state.

If a Y2 (or Y2_SPT) call begins while the unit was under "Y1 cooling" control, compressor no. 2 will not be started until "Y1 cooling" control has ended.

If the Y2 (or Y2_SPT) call ends, with compressor 1 in an unloaded state and compressor 2 ON, then compressor 1 will be immediately brought up to the fully loaded state. If however, the Y2 (or Y2_SPT) call ends, with compressor 1 in an unloaded state and compressor 2 OFF, then compressor 1 will be left in its unloaded state. In either case the compressor 1 will be loaded/unloaded as appropriate to the "Y1 Low Limit".

The control shall lockout compressors if SAT becomes too low and an alarm shall be issued.

Compressor no. 1 lockout at SAT < 53 F.

Compressor no. 2 lockout at SAT < 48 F.

If SAT sensor fails the control will energize compressor no. 1 fully loaded (unloaders off), whenever there is a Y1 (or Y1_SPT) call. Compressor no. 2 will be energized whenever there is a call for Y2 (or Y2_SPT).

NOTE: When a VAV unit with software version 4.0 and later is configured to operate from a space thermostat (VVT® relay pack) or a space sensor, compressors start loaded and then unload as needed. This is the opposite of the normal VAV unloading sequence. When operating from supply-air temperature (SAT) sensor, VAV units will unload in the reverse sequence.

FIELD TEST — The field test program is initiated by moving up DIP switch no. 4 to the OPEN position. The outdoor-air damper will close. The control allows 90 seconds for the damper to close in case it was in the full open position. Next, the indoor-fan contactor will be energized, and the outside-air damper will begin to open to its default value of 20% and stay at that position for a short period of time. The outdoor-air damper will then open to its full open position and stay at that position for a short period of time. The outdoor-air damper will then close.

If the unit is equipped with power exhaust, stage 1 will be energized for 5 seconds. If the unit is configured for stage 2 of power exhaust, stage 2 will be energized for 5 seconds after the first stage is deenergized.

The first stage of heat will be energized for 30 seconds, after which the second stage heat will be energized for an additional 30 seconds. Heat is then deenergized.

The last step is the Cooling mode. Outdoor-fan contactor no. 1 is energized. This is followed by each stage of cooling energized with a 10-second delay between stages. After this is complete, outdoor-fan contactor no. 2 is energized for 10 seconds.

The compressors will now deenergize, followed by the outdoor-fan contactors and indoor-fan contactors. If the unit is equipped with the Integrated Gas Control (IGC) board, the indoor fan will continue to operate for an additional 30 seconds after deenergizing the circuit.

The field test is then complete.

SERVICE

> **⚠ WARNING**
>
> Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

Service Access — All unit components can be reached through clearly labelled hinged access doors. These doors are not equipped with tiebacks, so if heavy duty servicing is needed, either remove them or prop them open to prevent accidental closure.

Each door is held closed with 3 latches. The latches are secured to the unit with a single 1/4-in. - 20 x 1/2-in. long bolt. See Fig. 63.

To open, loosen the latch bolt using a 7/16-in. wrench. Pivot the latch so it is not in contact with the door. Open the door. To shut, reverse the above procedure.

NOTE: Disassembly of the top cover may be required under special service circumstances. It is very important that the orientation and position of the top cover be marked on the unit prior to disassembly. This will allow proper replacement of the top cover onto the unit and prevent rainwater from leaking into the unit.

> IMPORTANT: After servicing is completed, make sure door is closed and relatched properly, and that the latches are tight. Failure to do so can result in water leakage into the evaporator section of the unit.

Cleaning — Inspect unit interior at beginning of each heating and cooling season and as operating conditions require. Remove unit side panels and/or open doors for access to unit interior.

MAIN BURNERS — At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust if necessary. Check spark gap. See Fig. 64. Refer to Main Burners section on page 94.

FLUE GAS PASSAGEWAYS — The flue collector box and heat exchanger cells may be inspected by removing gas section access panel (Fig. 5-16), flue box cover, collector box, and main burner assembly (Fig. 65 and 66). Refer to Main Burners section on page 94 for burner removal sequence. If cleaning is required, clean all parts with a wire brush. Reassemble using new high-temperature insulation for sealing.

COMBUSTION-AIR BLOWER — Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bi-monthly to determine proper cleaning frequency.

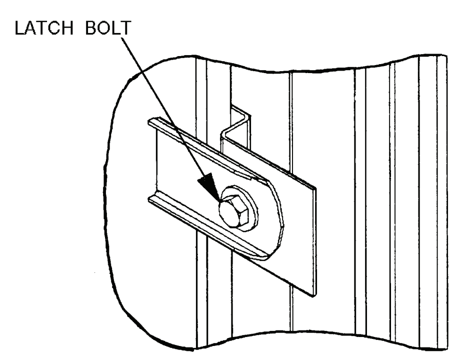


Fig. 63 — Door Latch

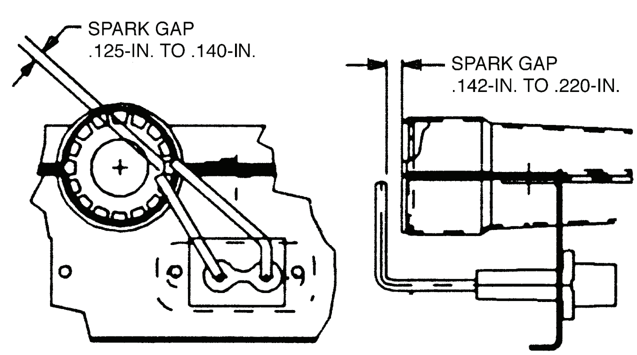
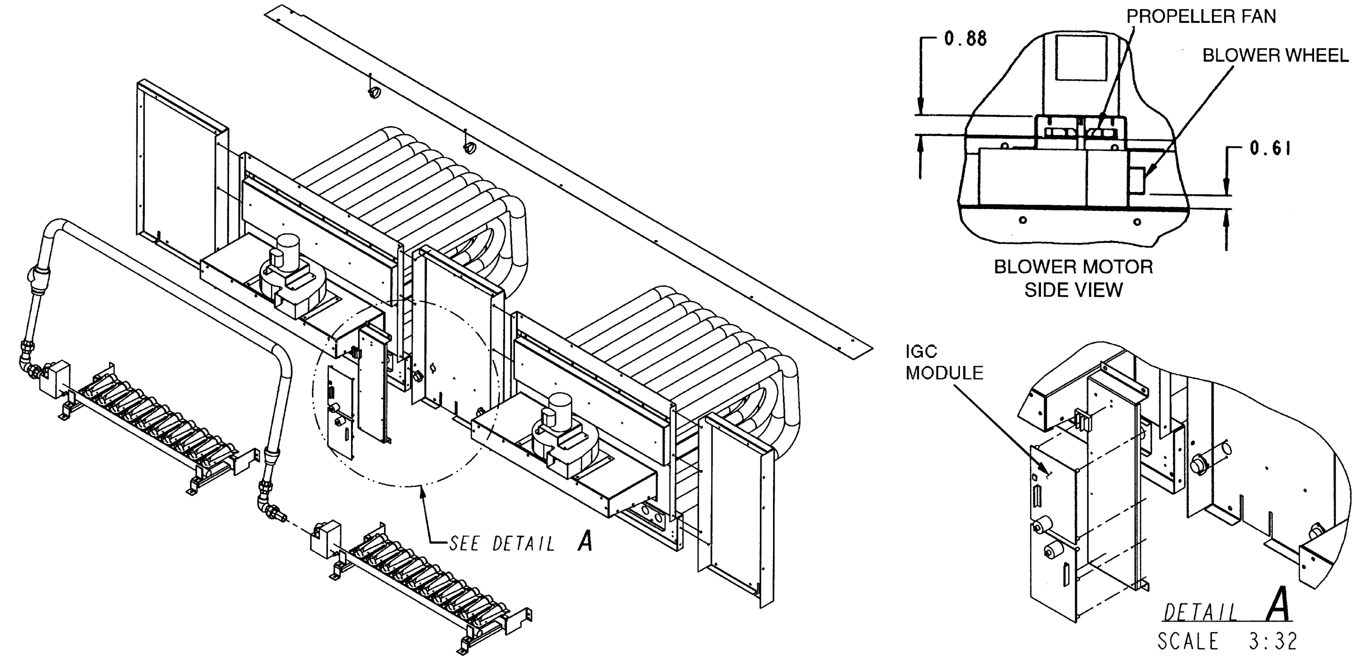


Fig. 64 — Spark Gap Adjustment



NOTES:
1. Torque set screws on blower wheel to 70 in. lbs ± 2 in. lbs.
2. Torque set screw on propeller fan to 15 in. lbs ± 2 in. lbs.
3. Dimensions are in inches.

Fig. 65 — Typical Gas Heating Section

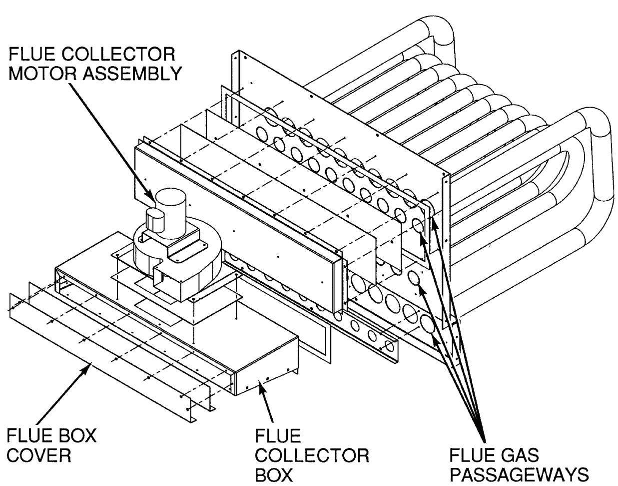


Fig. 66 — Gas Heat Section Details

To inspect blower wheel, remove heat exchanger access panel. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel assembly by removing screws holding motor mounting plate to top of combustion fan housing (Fig. 65 and 66). The motor, scroll, and wheel assembly can be removed from the unit. Remove scroll from plate. Remove the blower wheel from the motor shaft and clean with a detergent or solvent. Replace motor and wheel assembly.

EVAPORATOR COIL — Remove access panels and clean as required with commercial coil cleaner.

CONDENSER COIL — Clean condenser coil annually and as required by location and outdoor-air conditions. Inspect coil monthly; clean as required.

CONDENSATE DRAIN — Check and clean each year at start of cooling season. In winter, keep drains and traps dry.

FILTERS — Clean or replace at start of each heating and cooling season, or more often if operating conditions require. Refer to Tables 1A and 1B for type and size.

NOTE: The unit requires industrial grade throwaway filters capable of withstanding face velocities up to 625 fpm.

OUTDOOR-AIR INLET SCREENS — Clean screens with steam or hot water and a mild detergent. Do not use disposable filters in place of screens. See Fig. 37 for location of screens (filter track assembly).

Lubrication

COMPRESSORS — Each compressor is charged with the correct amount of oil at the factory. The correct oil charge is shown in Tables 1A and 1B. If oil is visible in the compressor sight glass, check unit for operating readiness as described in Start-Up section, then start the unit. Observe oil level and add oil, if required, to bring oil level in compressor crankcase up to between $^1/_4$ and $^1/_3$ of sight glass during steady operation.

If oil charge is above $^1/_3$ sight glass, do not remove any oil until the compressor crankcase heater has been energized for at least 24 hours with compressor off.

When additional oil or a complete charge is required, use only Carrier-approved compressor oil:

Petroleum Specialties, Inc. . . . . Cryol 150
Texaco, Inc. . . . . Capella WF-32
Witco Chemical Corp . . . . Suniso 3GS

> IMPORTANT: Do not use reclaimed oil or oil that has been exposed to the atmosphere. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants section, for procedures to add or remove oil.

FAN SHAFT BEARINGS — Lubricate bearings at least every 6 months with suitable bearing grease. Do not over grease. Typical lubricants are given below:

MANUFACTURER	LUBRICANT
Texaco	Regal AFB-2*
Mobil	Mobilplex EP No. 1
Sunoco	Prestige 42
Texaco	Multifak 2

*Preferred lubricant because it contains rust and oxidation inhibitors.

CONDENSER- AND EVAPORATOR-FAN MOTOR BEARINGS — The condenser- and evaporator-fan motors have permanently-sealed bearings, so no field lubrication is necessary.

Evaporator Fan Performance Adjustment (Fig. 67) — Fan motor pulleys are designed for speed shown in Tables 1A and 1B (factory speed setting).

> IMPORTANT: Check to ensure that the unit drive matches the duct static pressure using Tables 19-31.

To change fan speeds, change pulleys.

To align fan and motor pulleys:

1. Shut off unit power supply.
2. Loosen fan shaft pulley bushing.
3. Slide fan pulley along fan shaft.
4. Make angular alignment by loosening motor from mounting plate.
5. Retighten pulley.
6. Return power to the unit.

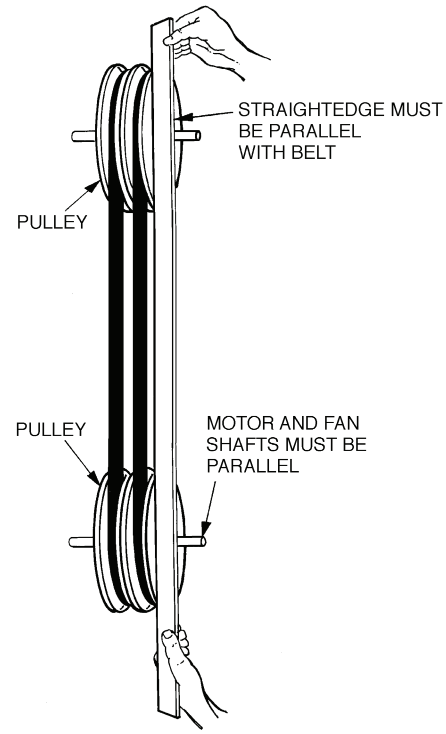


Fig. 67 — Evaporator-Fan Alignment and Adjustment

Evaporator Fan Coupling Assembly — If the coupling has been removed for other blower assembly component repair or replacement, it is critical that the coupling be reassembled and aligned correctly to prevent premature failures.

REASSEMBLING THE COUPLING INTO THE UNIT (Fig. 68)

1. Prior to reassembling the coupling, loosen the 4 bearing mounting bolts, which secure the 2 bearings on either side of the coupling. Remove the drive belts.
2. Reassemble the coupling with the bearings loose. This allows the coupling to find its own self-alignment position.
3. Check the hub-to-shaft fit for close fitting clearances. Replace hubs if high clearances are determined.
4. Check the key for close-fitted clearances on the sides and 0.015 in. clearance over the top of the key. Replace key if necessary.

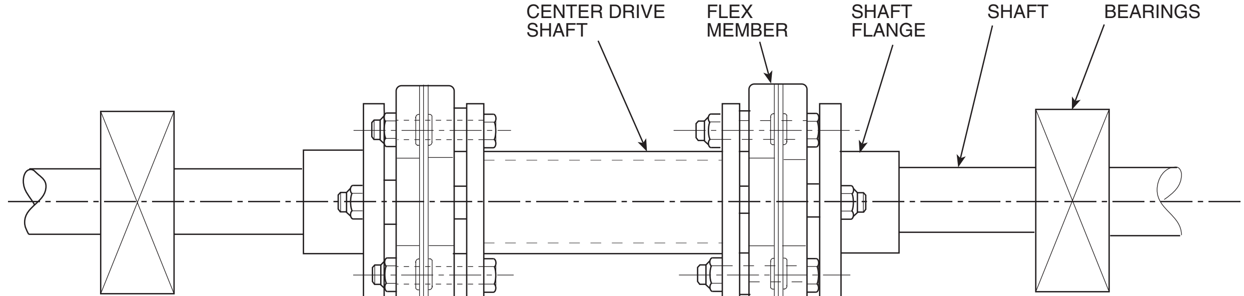


Fig. 68 — Evaporator Fan Coupling

5. Be sure that hub flanges, flex members, spacer, and hardware are clean and free of oil.
6. Place the flanges onto the shafts with the hub facing outward. Do not tighten the set screws at this time.
7. Outside of the unit, assemble the flex members to the center drive shaft with 4 bolts and nuts. The flex members have collars that need to be inserted into the smaller hole of the drive shaft flange.
8. Assemble the flex member/drive shaft assembly to one of the shaft flanges, using 2 bolts and nuts. Slide the other shaft flange towards the assembly and assemble using 2 bolts and nuts. If the shafts are not misaligned, the collar in the flex member should line up with the shaft flange holes.
9. Torque nuts properly to 95 to 100 ft-lb. Do not turn a coupling bolt. Always turn the nut. Always use thread lubricant or anti-seize compound to prevent thread galling.
10. The ends of the shafts should be flush with the inside of the shaft flange. Torque the set screws to 25 ft-lb.
11. After assembly is complete, slowly rotate the shafts by hand for 30 to 60 seconds.
12. Tighten the bearing mounting bolts, using care not to place any loads on the shaft which would cause flexure to the shafts.
13. Reinstall drive belts. (Refer to Belt Tension Adjustment section below.)
14. Visually inspect the assembly. If the shafts are overly misaligned, the drive shaft flange will not be parallel with the shaft flanges.
15. Recheck nut torque after 1 to 2 hours of operation. Bolts tend to relax after being initially torqued.

Evaporator Fan Service and Replacement

1. Turn off unit power supply.
2. Remove supply-air section panels.
3. Remove belt and blower pulley.
4. Loosen setscrews in blower wheels.
5. Remove locking collars from bearings.
6. Remove shaft.
7. Remove venturi on opposite side of bearing.
8. Lift out wheel.
9. Reverse above procedure to reinstall fan.
10. Check and adjust belt tension as necessary.
11. Restore power to unit.

Belt Tension Adjustment — To adjust belt tension:

1. Turn off unit power supply.
2. Loosen motor mounting nuts and bolts. See Fig. 69.
3. Loosen fan motor nuts.
4. Turn motor jacking bolts to move motor mounting plate left or right for proper belt tension. A slight bow should be present in the belt on the slack side of the drive while running under full load.
5. Tighten nuts.
6. Adjust bolts and nut on mounting plate to secure motor in fixed position. Recheck belt tension after 24 hours of operation. Adjust as necessary. See Table 3 for proper tension values.
7. Restore power to unit.

Evaporator-Fan Motor Replacement

1. Turn off unit power supply.
2. Remove upper outside panel and open hinged door to gain access to motor.
3. Fully retract motor plate adjusting bolts.
4. Loosen the 2 rear (nearest the evaporator coil) motor plate nuts.
5. Remove the 2 front motor plate nuts and carriage bolts.
6. Slide motor plate to the rear (toward the coil) and remove fan belt(s).
7. Slide motor plate to the front and hand tighten one of the rear motor plate nuts (tight enough to prevent the motor plate from sliding back but loose enough to allow the plate to pivot upward).
8. Pivot the front of the motor plate upward enough to allow access to the motor mounting hex bolts and secure in place by inserting a prop.
9. Remove the nuts from the motor mounting hex bolts and remove motor.
10. Reverse above steps to install new motor.

Condenser-Fan Adjustment

1. Turn off unit power supply.
2. Remove fan guard.
3. Loosen fan hub setscrews.
4. Adjust fan height on shaft using a straightedge placed across venturi and measure per Fig. 70.
5. Fill hub recess with permagum if rubber hubcap is missing.
6. Tighten setscrews and replace panel(s).
7. Turn on unit power.

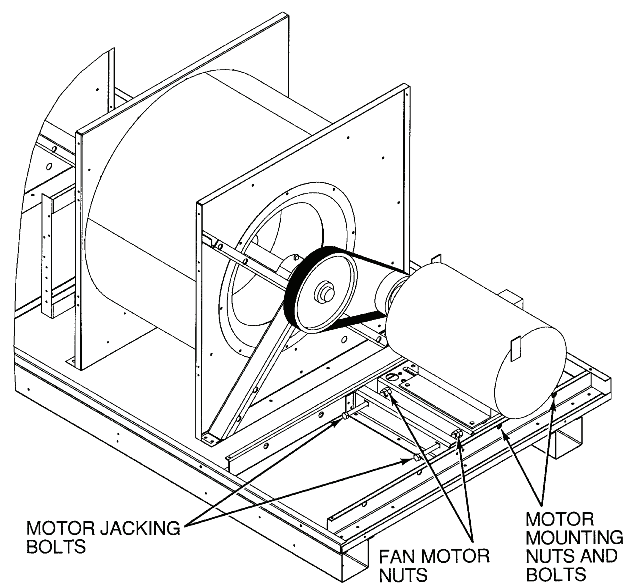


Fig. 69 — Belt Tension Adjustment

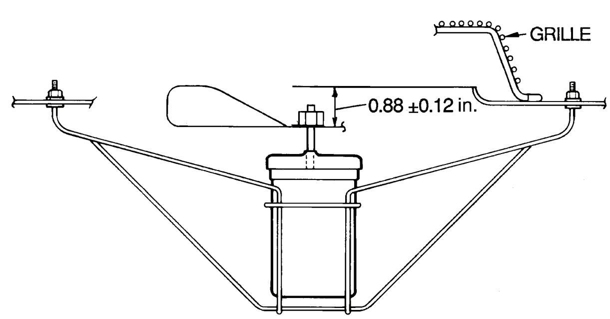


Fig. 70 — Condenser-Fan Adjustment

Power Failure — The economizer damper motor is a spring return design. In event of power failure, dampers will return to fully closed position until power is restored.

Refrigerant Charge — Amount of refrigerant charge is listed on unit nameplate and in Tables 1A and 1B. Refer to Carrier GTAC II; Module 5; Charging, Recovery, Recycling, and Reclamation section for charging methods and procedures.

Unit panels must be in place when unit is operating during charging procedure.

NOTE: Do not use recycled refrigerant as it may contain contaminants.

NO CHARGE — Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant (refer to Tables 1A and 1B).

LOW CHARGE COOLING — Using appropriate cooling charging chart (see Fig. 71-74), add or remove refrigerant until conditions of the appropriate chart are met. Note that charging chart is different from those normally used. An accurate pressure gage and temperature sensing device are required. Measure liquid line pressure at the liquid line service valve using pressure gage. Connect temperature sensing device to the liquid line near the liquid line service valve and insulate it so that outdoor ambient temperature does not affect reading.

Using the above temperature and pressure readings, find the intersect point on the appropriate cooling charging chart. If intersection point on chart is above line, add refrigerant. If intersection point on chart is below line, carefully reclaim some of the charge. Recheck suction pressure as charge is adjusted.

NOTE: Indoor-air cfm must be within normal operating range of unit. All outdoor fans must be operating.

Thermostatic Expansion Valve (TXV) — Each circuit has a TXV. The TXV is nonadjustable and is factory set to maintain 10 to 13° F superheat leaving the evaporator coil. The TXV controls flow of liquid refrigerant to the evaporator coils.

Gas Valve Adjustment

NATURAL GAS — The 2-stage gas valve opens and closes in response to the thermostat or limit control.

When power is supplied to valve terminals 3 and 4, the pilot valve opens to the preset position. When power is supplied to terminals 1 and 2, the main valve opens to its preset position.

The regular factory setting is stamped on the valve body (3.5 in. wg).

To adjust regulator:

1. Set thermostat at setting for no call for heat.
2. Turn main gas valve to OFF position.
3. Remove 1/8-in. pipe plug from manifold. Install a water manometer pressure-measuring device.
4. Set main gas valve to ON position.
5. Set thermostat at setting to call for heat (high fire).
6. Remove screw cap covering regulator adjustment screw (See Fig. 75).
7. Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.
8. Once desired pressure is established, set unit to no call for heat (3.3-in. wg high fire).
9. Turn main gas valve to OFF position.
10. Remove pressure-measuring device and replace 1/8-in. pipe plug and screw cap.
11. Turn main gas valve to ON position and check heating operation.

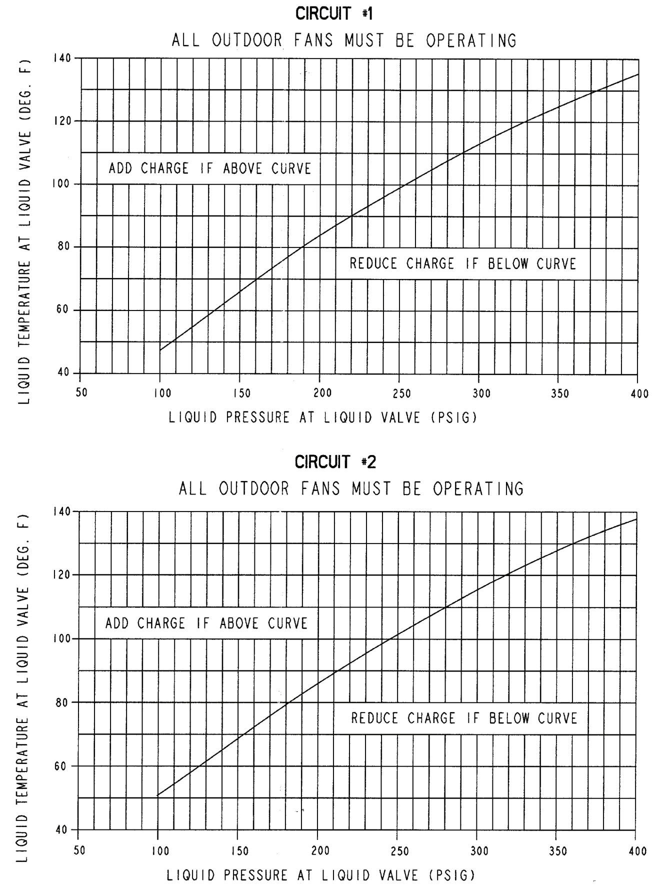


Fig. 71 — Cooling Charging Chart, 48EJ,EK,EW,EY024-034

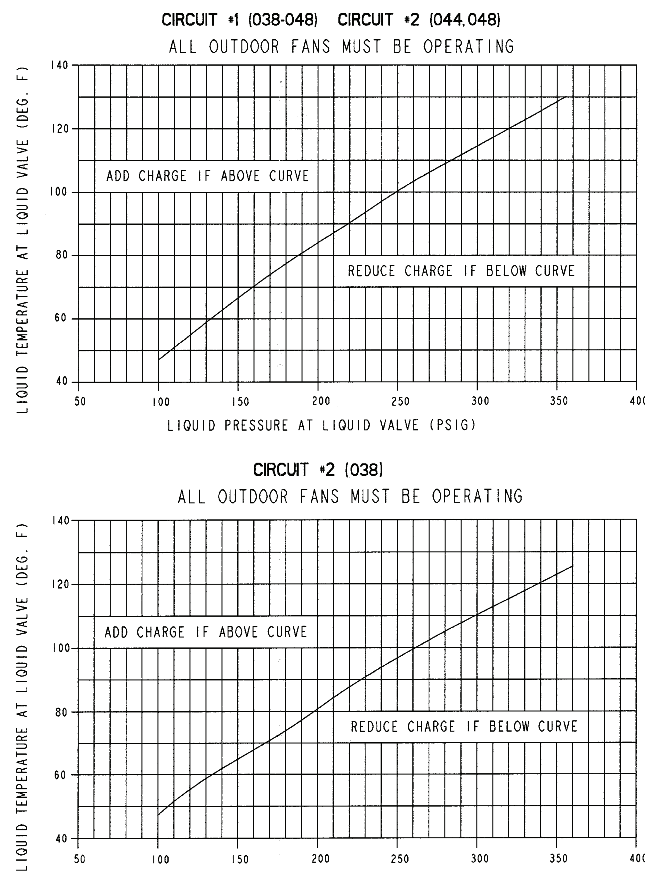


Fig. 72 — Cooling Charging Chart, 48EJ,EK,EW,EY038-048

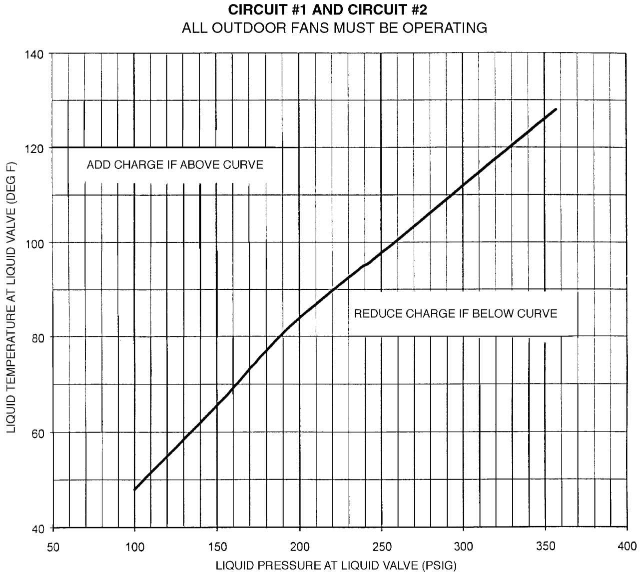


Fig. 73 — Cooling Charging Chart, 48EJ,EK,EW,EY054-068

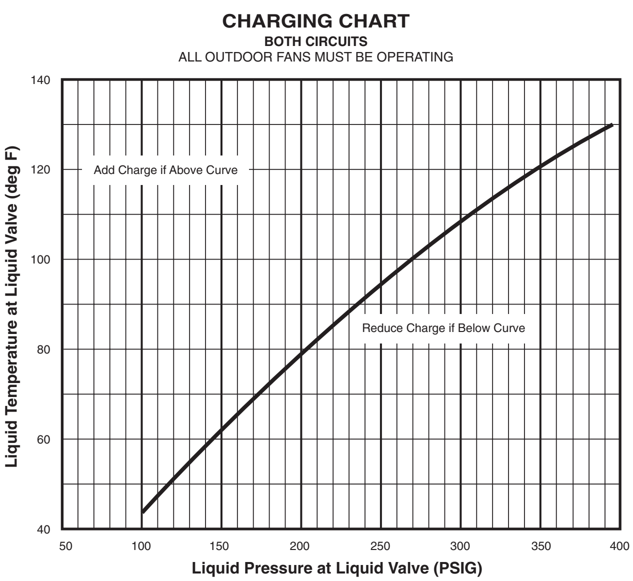


Fig. 74 — Cooling Charging Chart, 48AJ,AK,AW,AY020-060

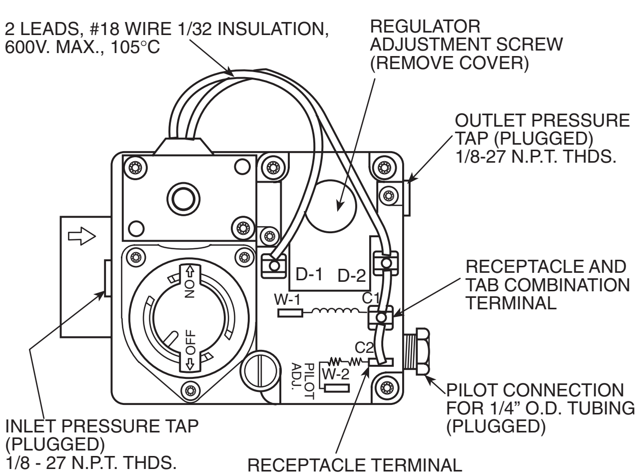


Fig. 75 — Gas Valve (Part Number EF33CB271)

Main Burners — For all applications, main burners are factory set and should require no adjustment.

MAIN BURNER REMOVAL (Fig. 76)

1. Shut off (field-supplied) manual main gas valve.
2. Shut off power supply to unit.
3. Remove heating access panel.
4. Disconnect gas piping from gas valve inlet.
5. Remove wires from gas valve.
6. Remove wires from rollout switch.
7. Remove sensor wire and ignitor cable from IGC board.
8. Remove 2 screws securing manifold bracket to basepan.
9. Remove 4 screws that hold the burner support plate flange to the vestibule plate.
10. Lift burner assembly out of unit.
11. Reverse procedure to re-install burners.

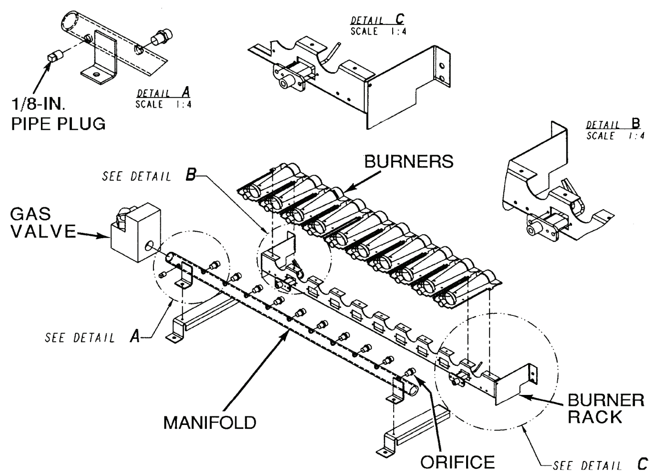


Fig. 76 — Main Burner Removal

Filter Drier — Replace whenever refrigerant system is exposed to atmosphere.

Protective Devices

COMPRESSOR PROTECTION

Overcurrent — Each compressor has one manual reset, calibrated trip, magnetic circuit breaker. Do not bypass connections or increase the size of the circuit breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

Overtemperature — Each 06D type compressor (48AJ,AK, AW,AY020-035 and 48EJ,EK,EW,EY024-038 units only) has an internal protector to protect it against excessively high discharge gas temperatures.

Crankcase Heater — Each compressor has a crankcase heater to prevent absorption of liquid refrigerant by oil in the crankcase when the compressor is idle. Since power for the crankcase heaters is drawn from the unit incoming power, main unit power must be on for the heaters to be energized.

> IMPORTANT: After a prolonged shutdown or service job, energize the crankcase heaters for 24 hours before starting the compressors.

EVAPORATOR FAN MOTOR PROTECTION — A manual reset, calibrated trip, magnetic circuit breaker protects against overcurrent. Do not bypass connections or increase the size of the breaker to correct trouble. Determine the cause and correct it before resetting the breaker. If the evaporator-fan motor is replaced with a different horsepower motor, resizing of the circuit breaker is required. Contact Carrier Application Engineering.

CONDENSER-FAN MOTOR PROTECTION — Each condenser-fan motor is internally protected against overtemperature.

HIGH- AND LOW-PRESSURE SWITCHES — If either switch trips, or if the compressor overtemperature switch activates, that refrigerant circuit will be automatically locked out. See Compressor Lockout Logic section on this page.

FREEZE PROTECTION THERMOSTAT (FPT) — Freeze protection thermostats are located on the evaporator coil for each circuit. One is located at the top and bottom of each coil. It detects frost build-up and turns off the compressor, allowing the coil to clear. Once the frost has melted, the compressor can be reenergized.

Relief Devices — All units have relief devices to protect against damage from excessive pressures (i.e., fire). These devices are installed on the suction line, liquid line, and on the compressor.

Power Circuit — A typical power wiring schematic is shown in Fig. 77.

Control Circuit, 24-V — This control circuit is protected against overcurrent by a 3.2 amp circuit breaker (CB4). Breaker can be reset. If it trips, determine cause of trouble before resetting. A typical 24-v control wiring schematic is shown in Fig. 78 and 79.

Control Circuit, 115-V — This control circuit is protected against overcurrent by a 5.2 amp circuit breaker (CB3). Breaker can be reset. If it trips, determine cause of trouble before resetting. A typical 115-v control wiring schematic is shown in Fig. 80 and 81.

Compressor Lockout Logic — If any of the safeties trip, the circuit will automatically reset (providing the safety has reset) and restart the compressor in 15 minutes. If any of the safeties trip 3 times within a 90-minute period, then the circuit will be locked out and will require manual resetting by turning off either the unit disconnect or the control circuit breaker, or opening the thermostat.

If the compressors have bee off for more than 15 minutes and the outdoor-air temperature (OAT) is less than 45 F then safeties will be ignored for 5 minutes.

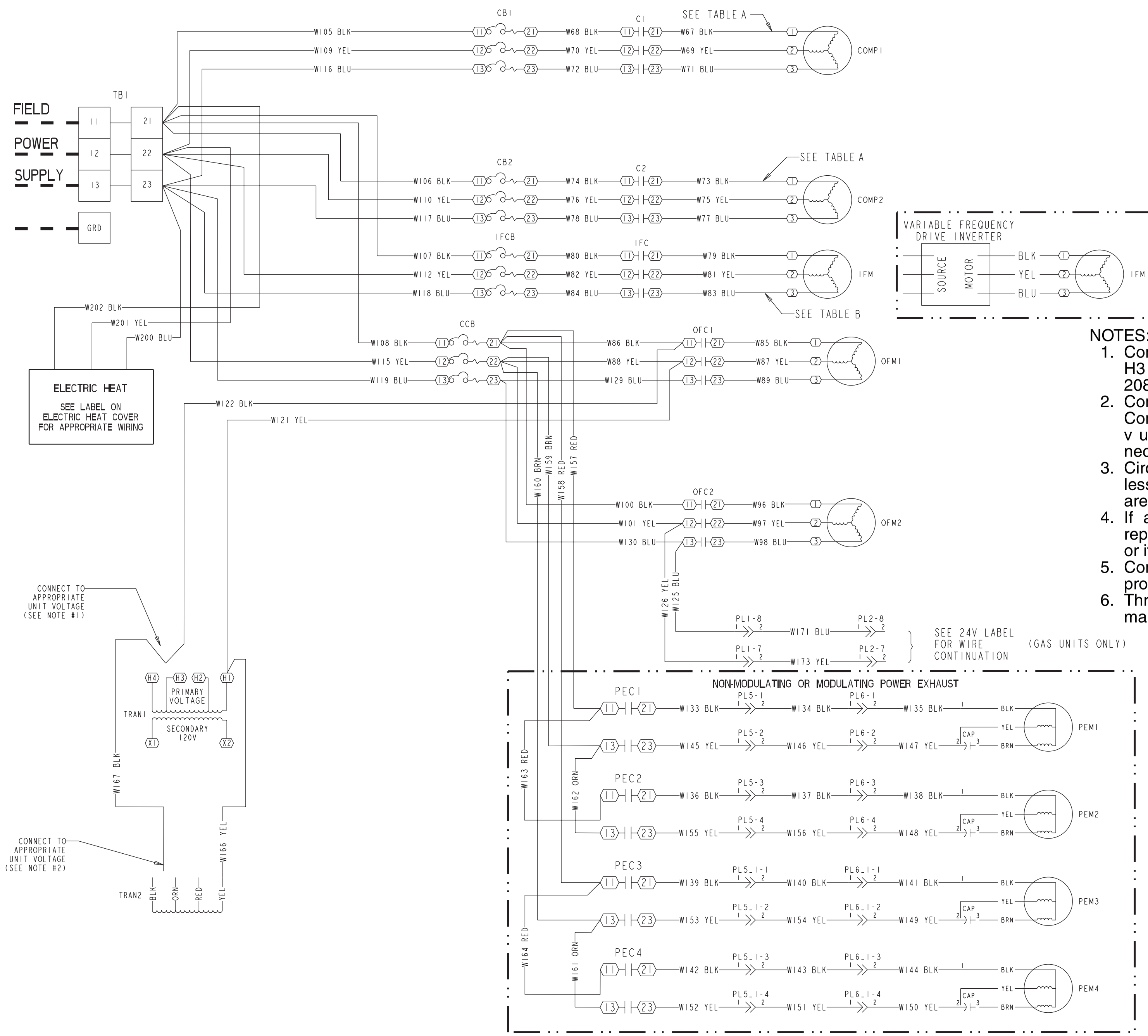
Replacement Parts — A complete list of replacement parts may be obtained from any Carrier distributor upon request.

LEGEND for Fig. 77-83 — Typical Wiring Schematics

LEGEND

AFS — Airflow Switch
AHA — Adjustable Heat Anticipator
BP — Building Pressure
BR — Burner Relay
C — Contactor, Compressor
CAP — Capacitor
CB — Circuit Breaker
CC — Cooling Compensator
CCB — Controller Circuit Breaker
CCH — Crankcase Heater
CLSASP — Cooling Supply Air Set Point Potentiometer
COM — Communication
COMP — Compressor Motor
CR — Control Relay
CV — Constant Volume
DM — Damper Motor
DP — Duct Pressure
EC — Enthalpy Control
FLA — Full Load Amps
FPT — Freeze Protection Thermostat
FU — Fuse
GVR — Gas Valve Relay
HPS — High-Pressure Switch
HS — Hall Effect Sensor
HTSASP — Heating Supply Air Set Point Potentiometer
HV — High Voltage
IDM — Induced-Draft Motor
IFC — Indoor Fan Contactor
IFCB — Indoor Fan Circuit Breaker
IFM — Indoor-Fan Motor
IFR — Indoor-Fan Relay
IGC — Integrated Gas Unit Controller
IP — Internal Protector
L — Light
LPS — Low-Pressure Switch
LS — Limit Switch
MGV — Main Gas Valve
NC — Normally Closed
NO — Normally Open
OAT — Outdoor-Air Thermostat
OD — Outdoor
OFC — Outdoor-Fan Contactor
OFM — Outdoor-Fan Motor
PEC — Power Exhaust Contactor
PEM — Power Exhaust Motor
PES — Power Exhaust Sequencer
PESC — Power Exhaust Sequencer Controller
PL — Plug Assembly
RAT — Return-Air Thermistor
RS — Rollout Switch
SAT — Supply-Air Thermostat
SEN — Sensor
SW — Switch
TB — Terminal Block
TC — Thermostat, Cooling
TH — Thermostat, Heating
TRAN — Transformer
UL — Compressor Unloader
VFD — Variable Frequency Drive

Terminal (Marked)
Terminal (Unmarked)
Terminal Block
Splice
Factory Wiring
Field Wiring
To indicate common potential only. Not to represent wiring.



NOTES:

1. Connect TRAN1 to H4 for 460 v units. Connect to H3 for 230 v. If 208/230 v units are run with a 208-v power supply, connect to H2.
2. Connect TRAN2 to black lead for 460 v units. Connect to orange lead for 230 v units. If 208/230 v units are run with a 208-v power supply, connect to red lead.
3. Circuit breaker must trip amps are equal to or less than 156% FLA for CB1 and CB2. All others are 140%.
4. If any of the original wire furnished must be replaced, it must be replaced with Type 90 C wire or its equivalent.
5. Compressors and/or fan motors are thermally protected.
6. Three phase motors are protected against primary single phasing conditions.

TABLE 1A

The following compressors have two parallel wires run from TB1 to the compressors.

Compressor Model	Voltage	Wire Quantity
06D-537	208/230-3-60	2

TABLE 2B

The following fan motors have two parallel wires run from TB1 to the fan motors.

Indoor Motor	Voltage	Wire Quantity
20 HP	208/230-3-60	2

Fig. 77 — Typical Power Schematic 48EJ,EK,EW,EY024-034; 208/230-3-60 and 460-3-60

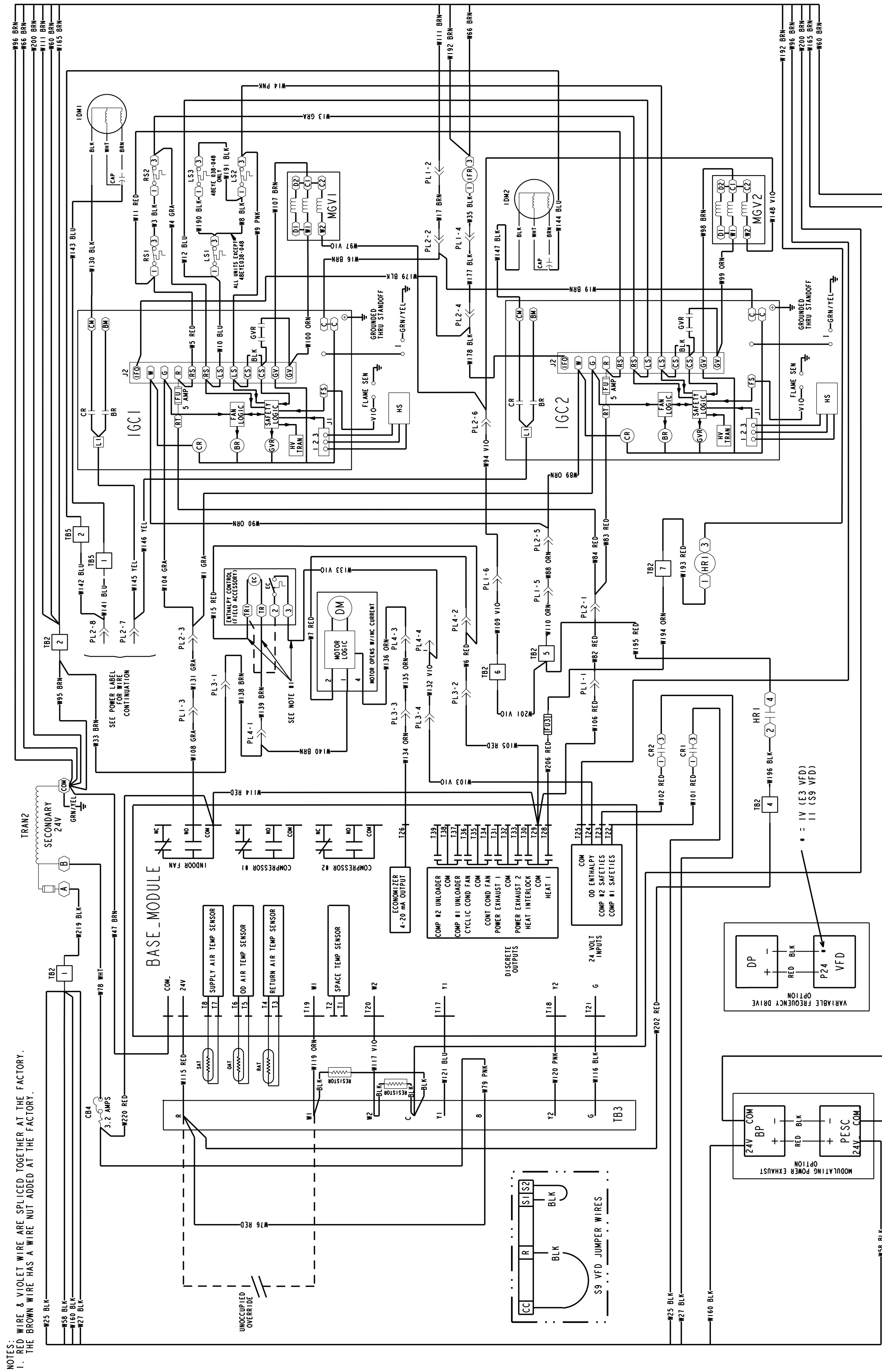
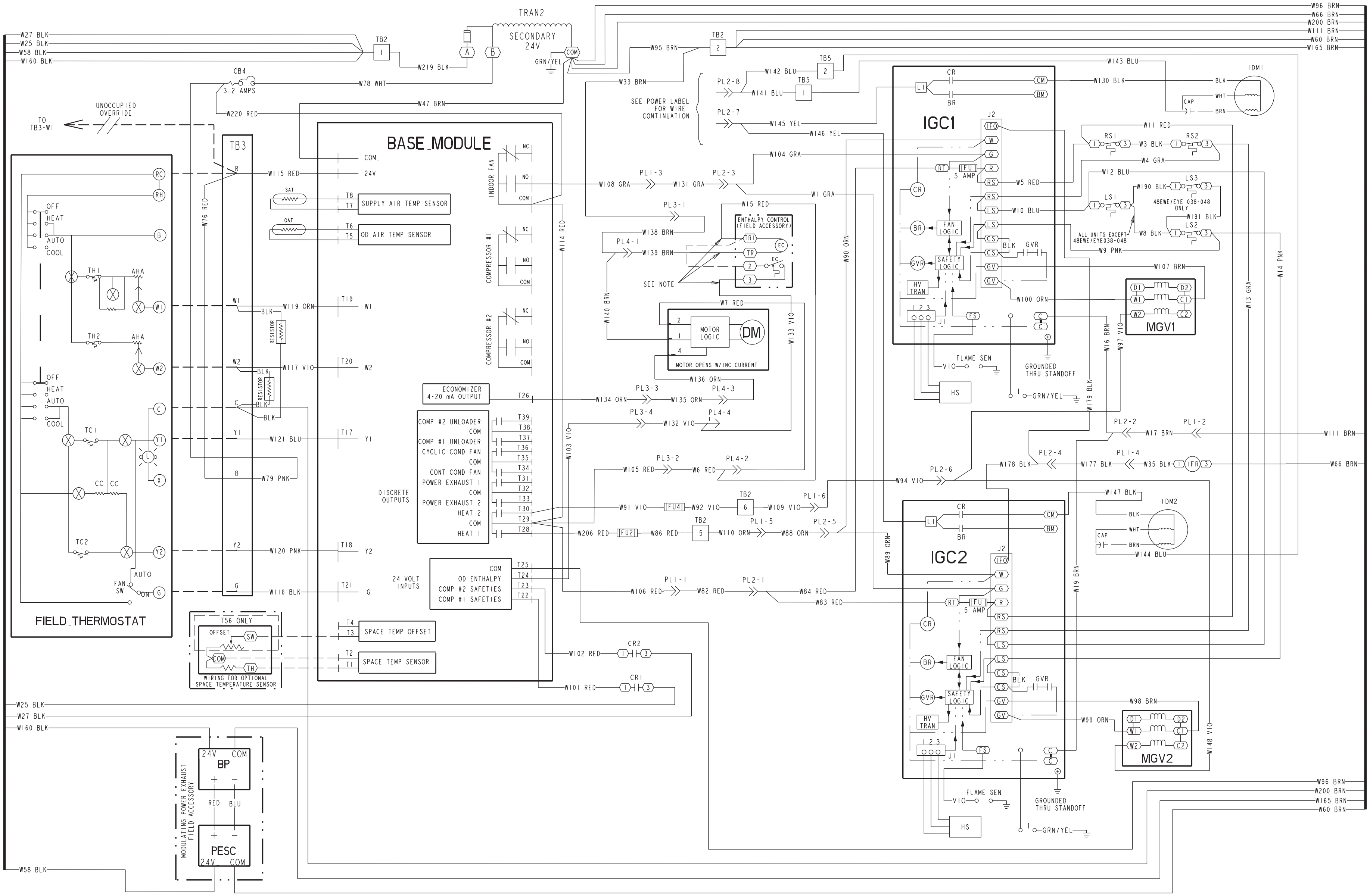


Fig. 78 — Typical 48EK VAV 24-V Control Circuit



NOTE: Red wire and violet wire are spliced together at the factory. The brown wire has a wire nut added at the factory.

Fig. 79 — Typical CV 24-V Control Circuit

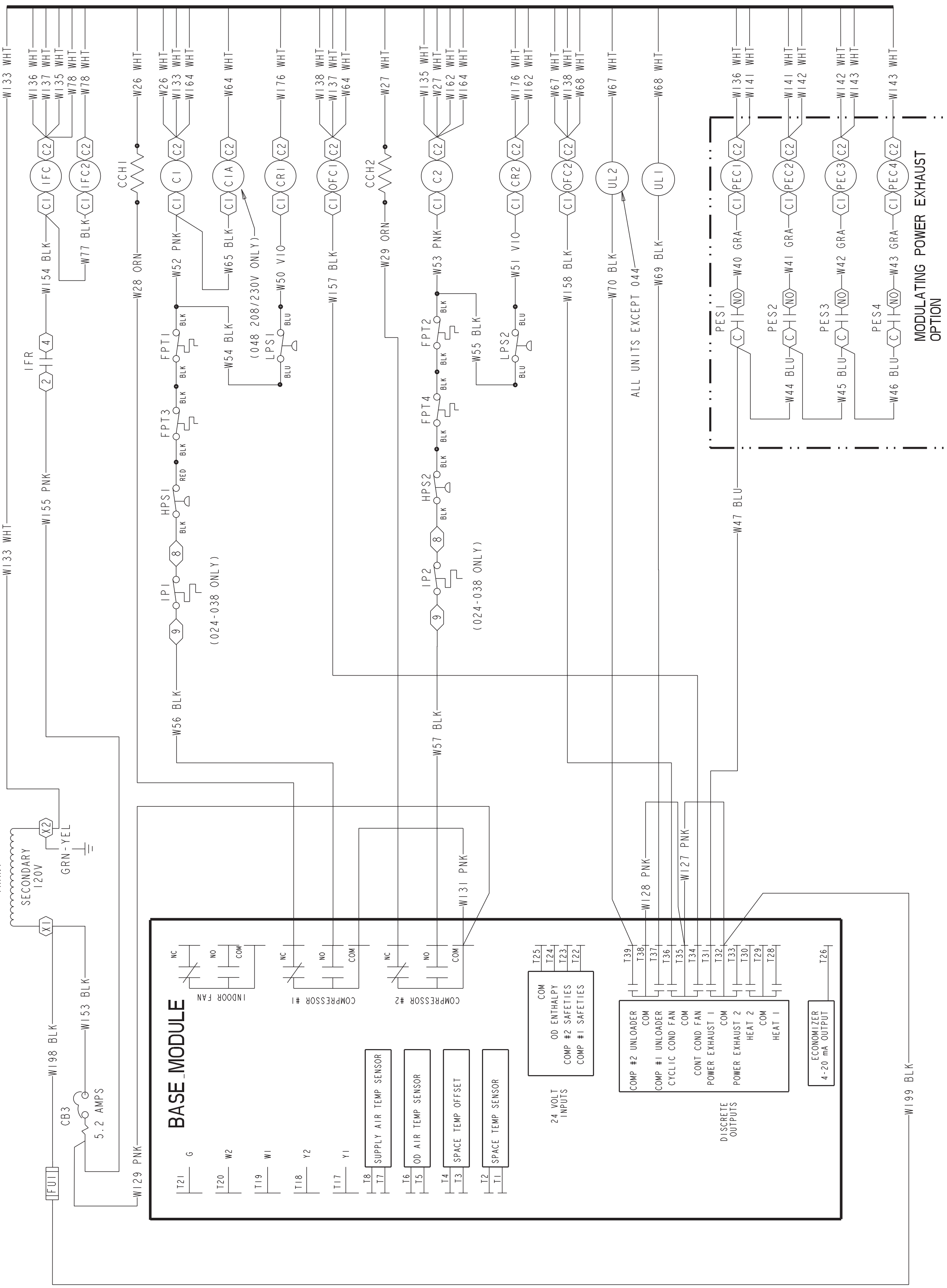


Fig. 80 — Typical 48EK VAV 115-V Control Circuit

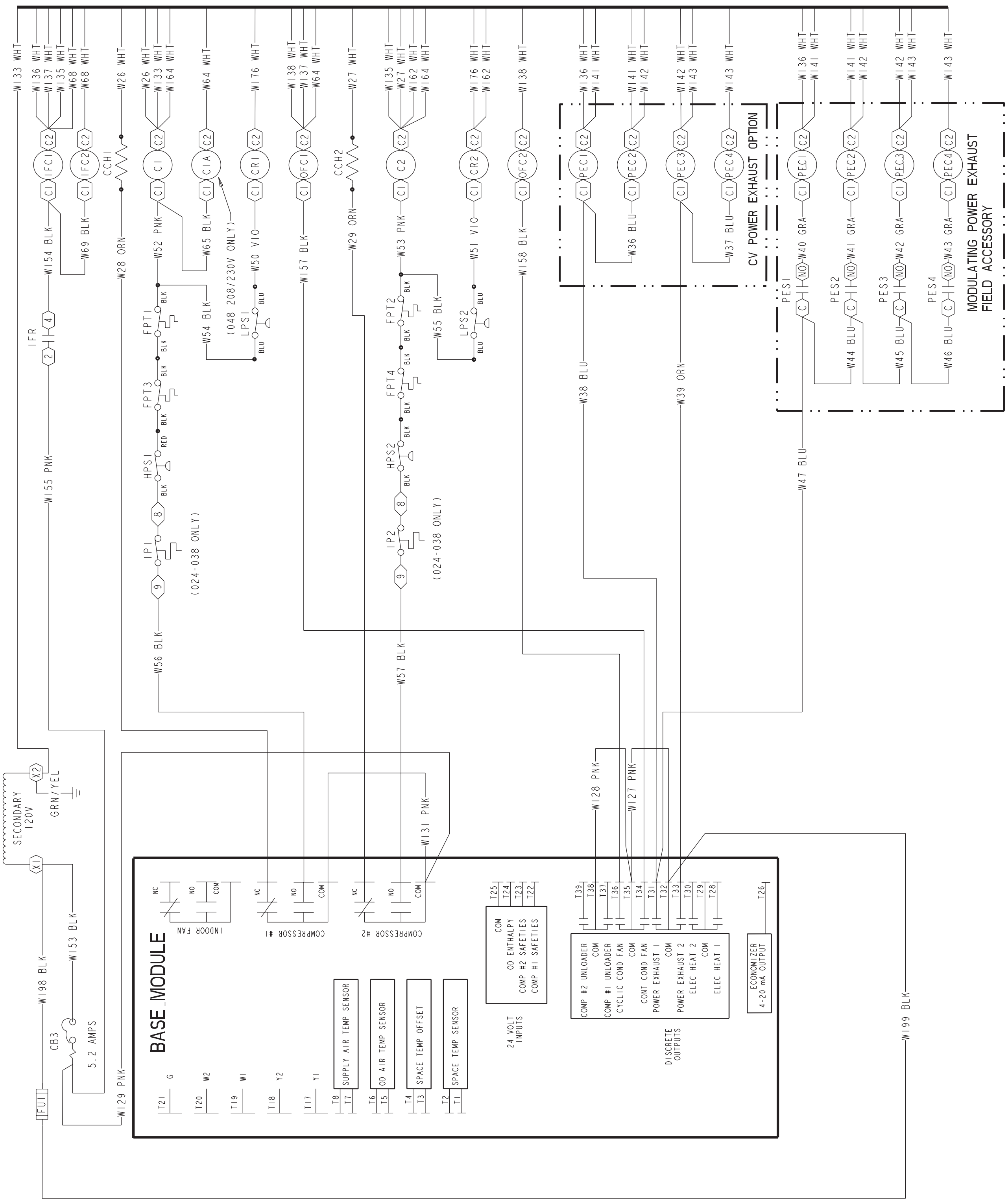


Fig. 81 — Typical 48EJ CV 115-V Control Circuit

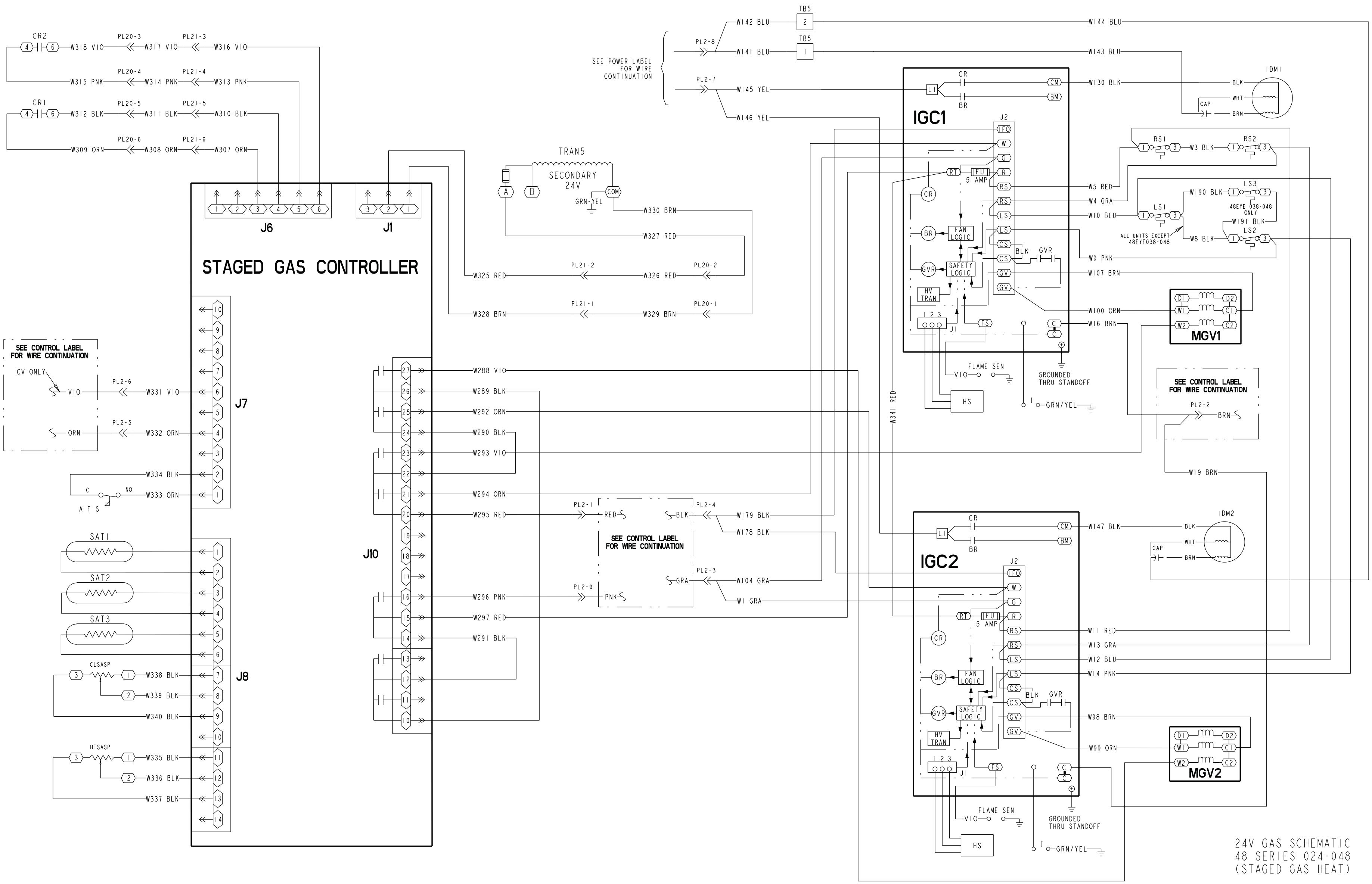


Fig. 82 — Label Diagram — Staged Gas Heat — 48AJ,AK,AW,AY020-050 and 48EJ,EK,EW,EY024-048 Units

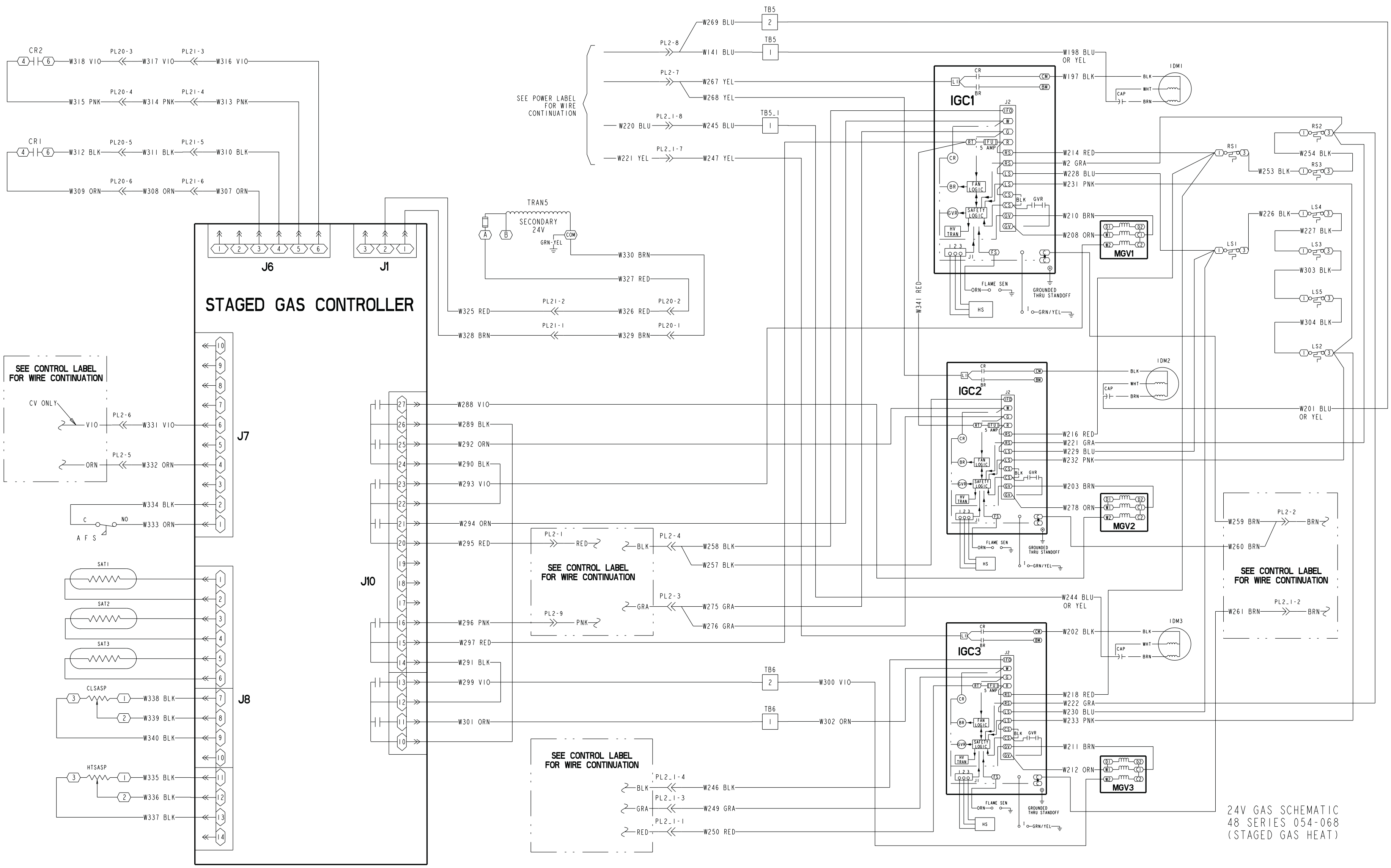
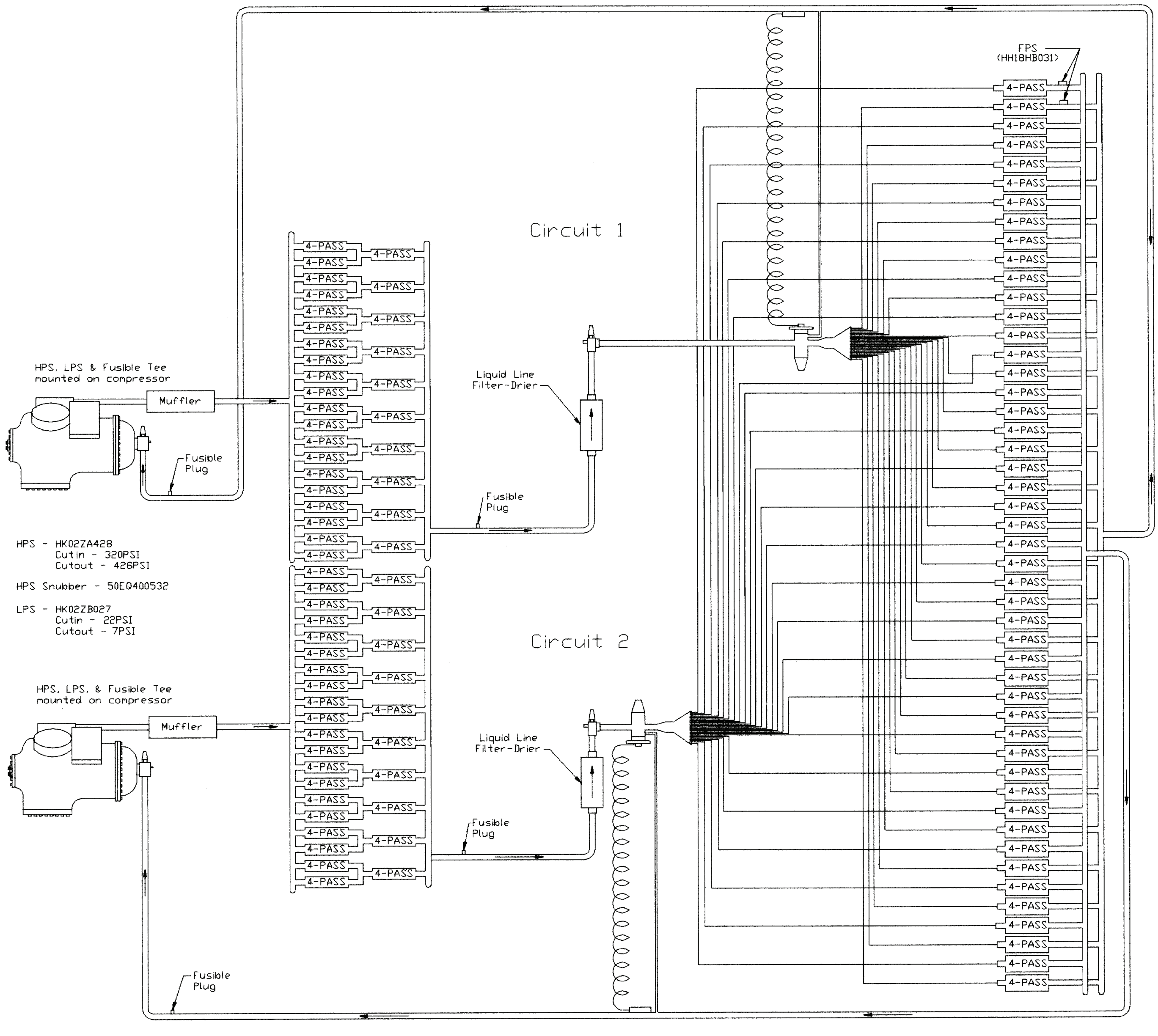


Fig. 83 — Label Diagram — Staged Gas Heat — 48AJ,AK,AW,AY060 and 48EJ,EK,EW,EY054-068 Units

TROUBLESHOOTING

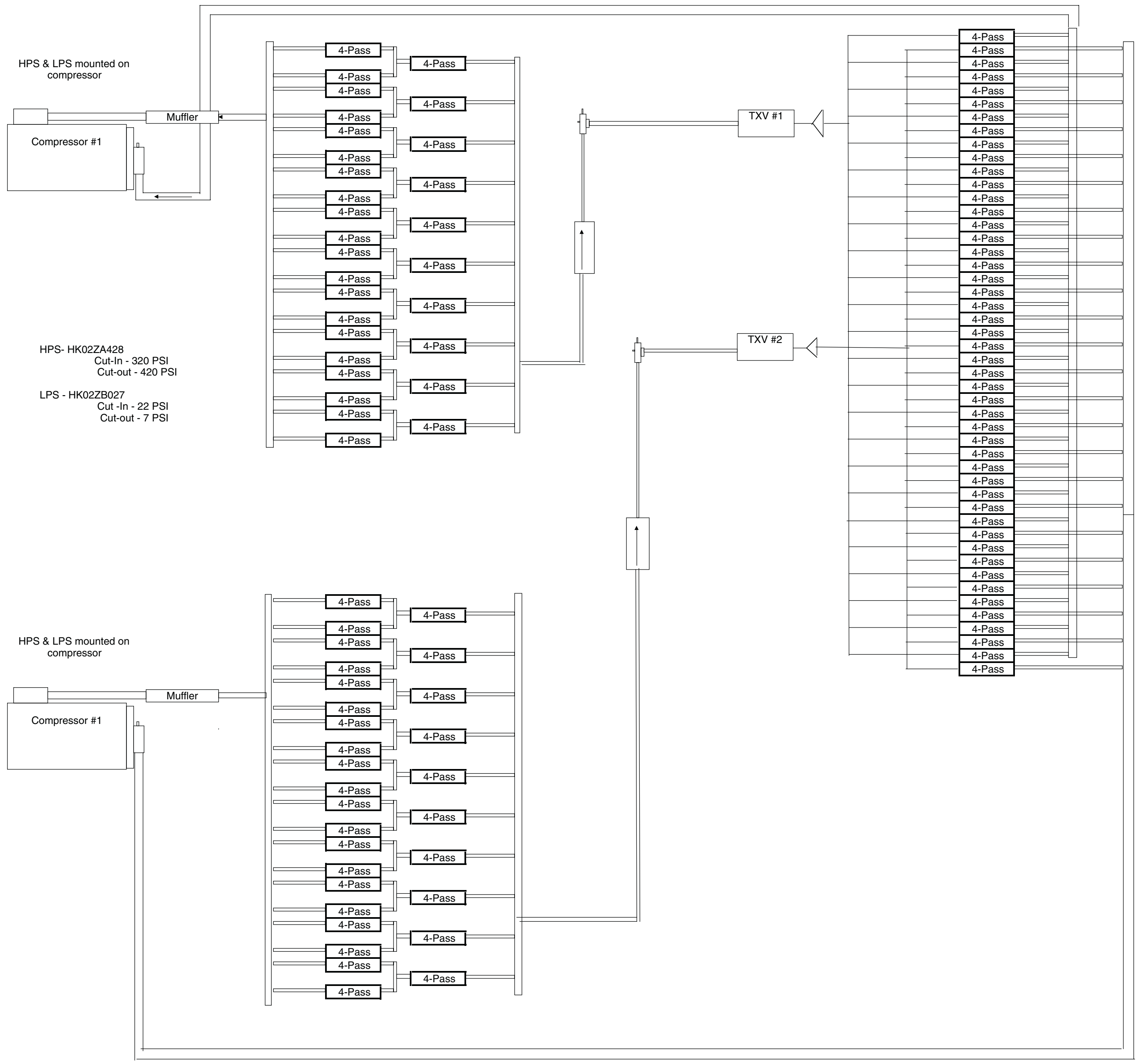
Typical refrigerant circuiting diagrams are shown in Fig. 84-93. An algorithm diagram of the IGC (Integrated Gas Unit Controller) control is shown in Fig. 94.



LEGEND

FPS — Freeze Protection Switch
HPS — High-Pressure Switch
LPS — Low-Pressure Switch

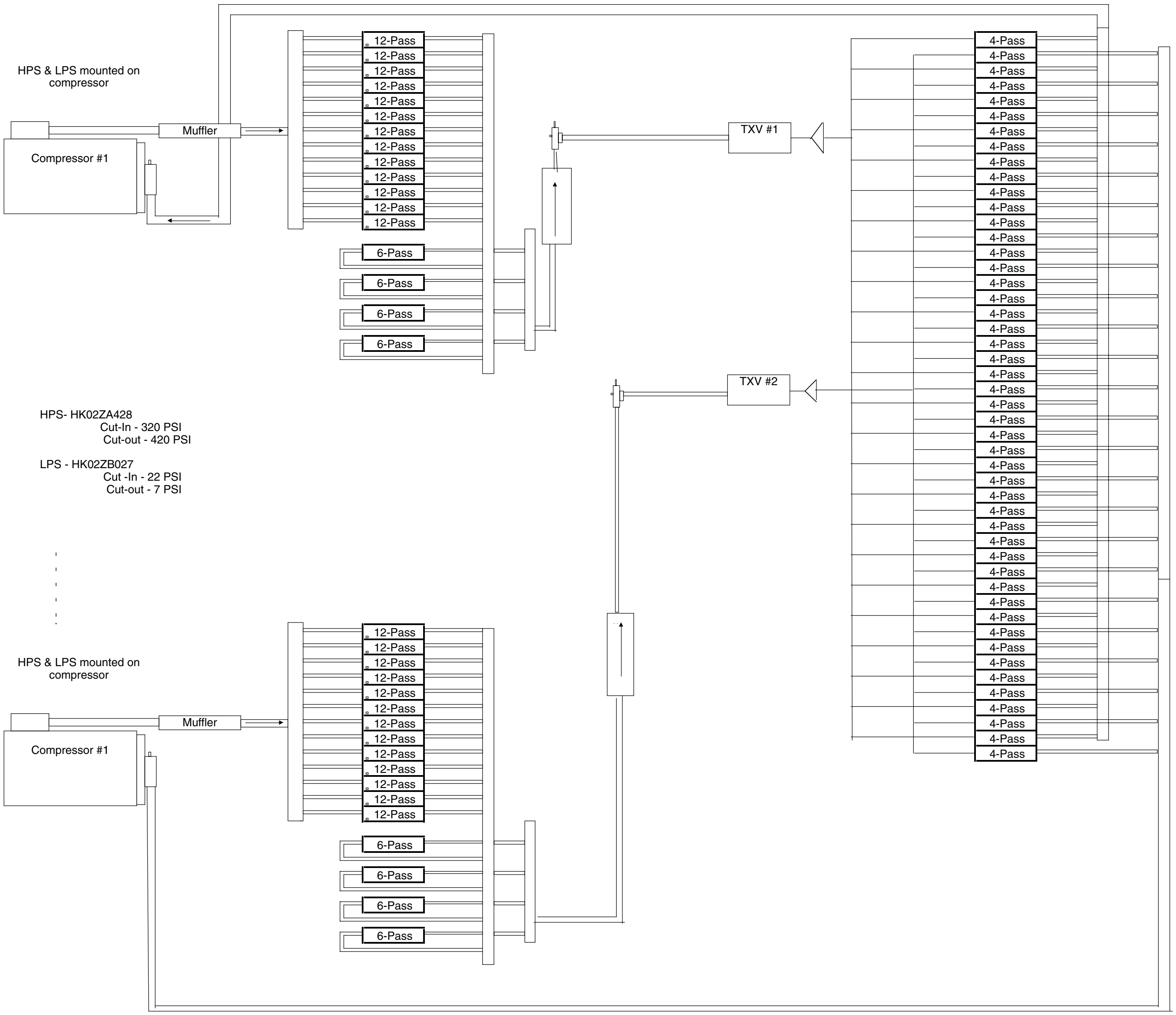
Fig. 84 — Typical Refrigerant Circuiting (48AJ,AK,AW,AY020,025 and 48EJ,EK,EW,EY024-034)



LEGEND

FPS — Freeze Protection Switch
HPS — High-Pressure Switch
LPS — Low-Pressure Switch
TXV — Thermostatic Expansion Valve

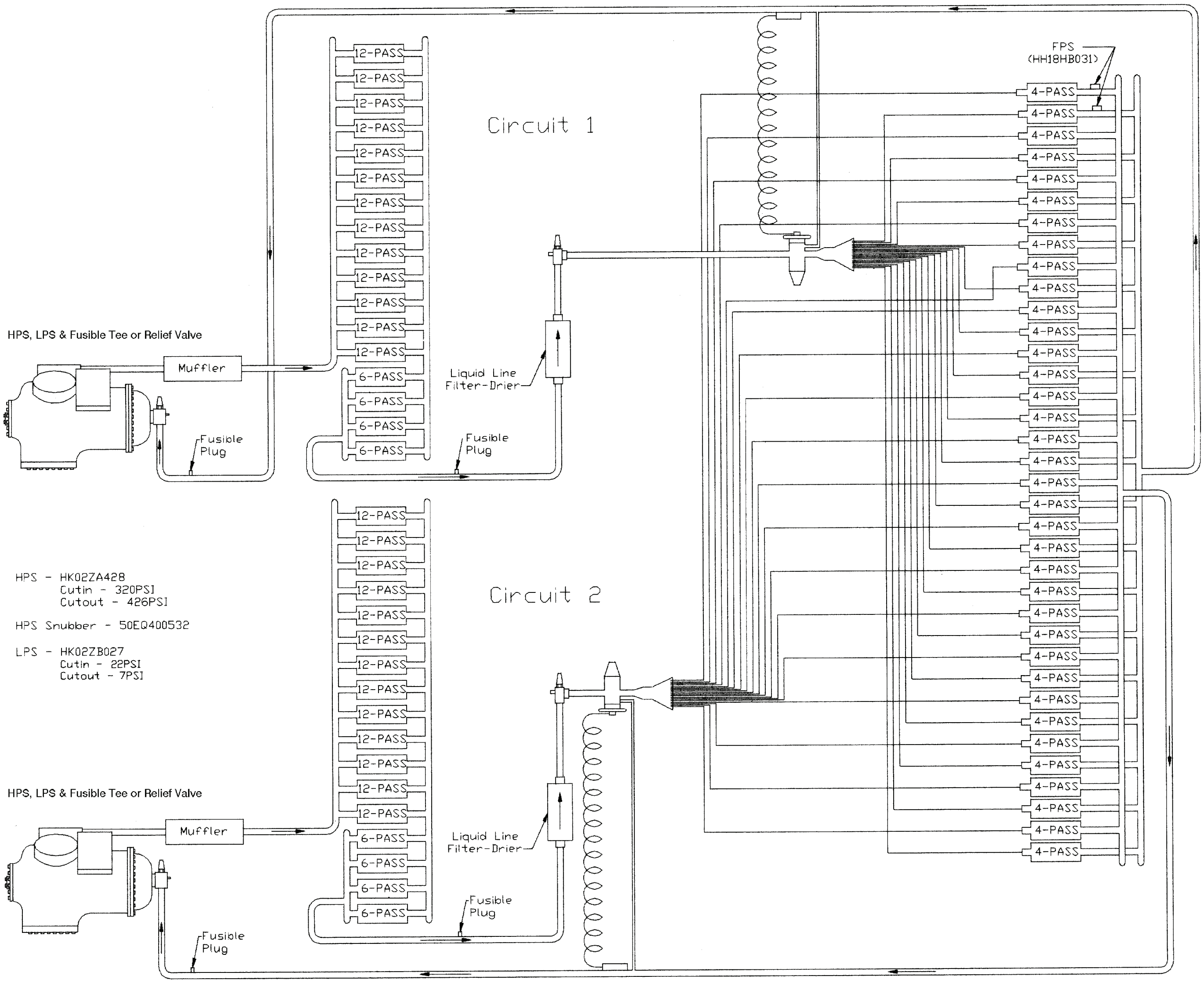
Fig. 85 — Typical Refrigerant Circuiting (48AJ,AK,AW,AY027,030)



LEGEND

FPS — Freeze Protection Switch
HPS — High-Pressure Switch
LPS — Low-Pressure Switch
TXV — Thermostatic Expansion Valve

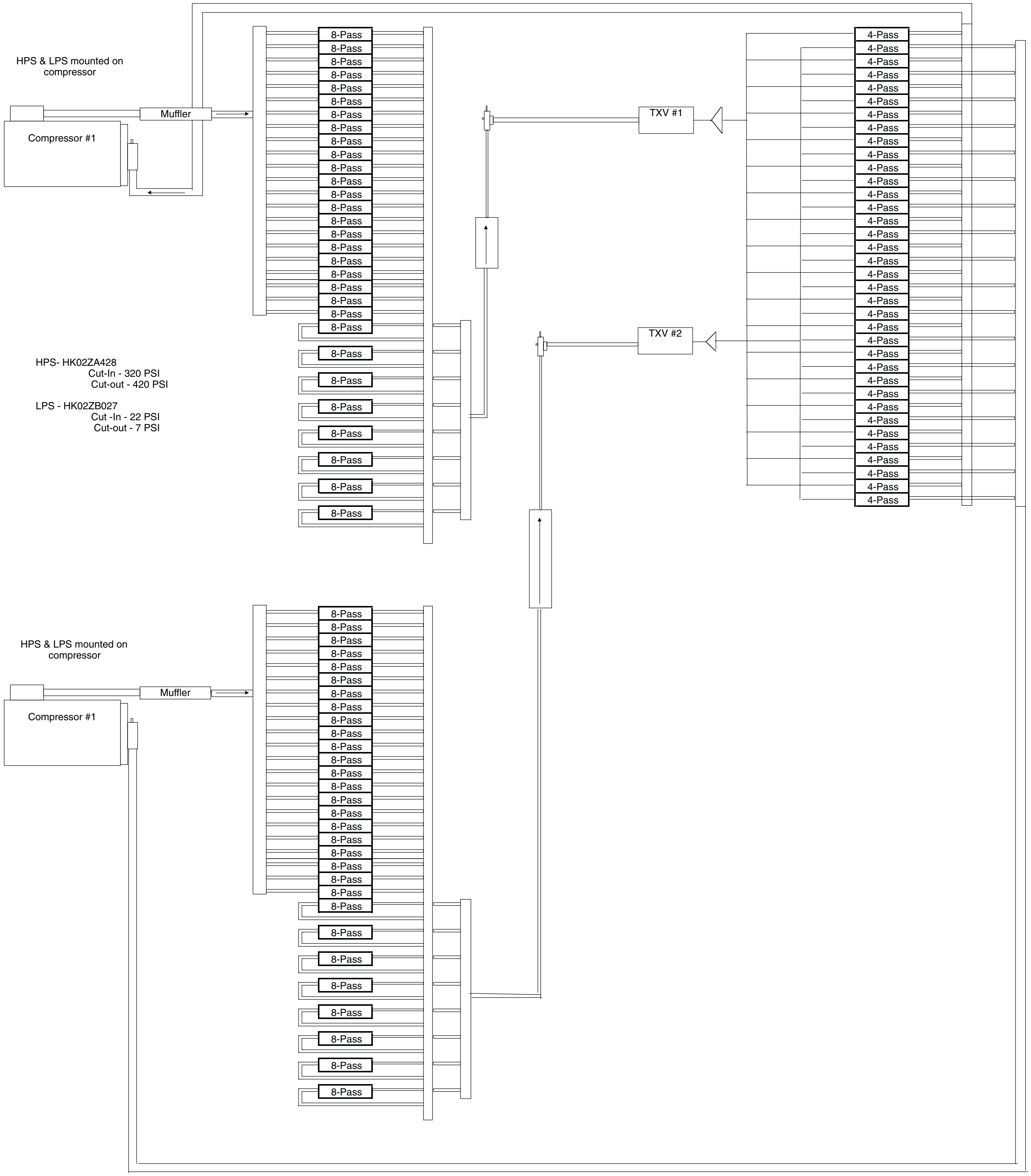
Fig. 86 — Typical Refrigerant Circuiting (48AJ,AK,AW,AY035)



LEGEND

FPS — Freeze Protection Switch
HPS — High-Pressure Switch
LPS — Low-Pressure Switch

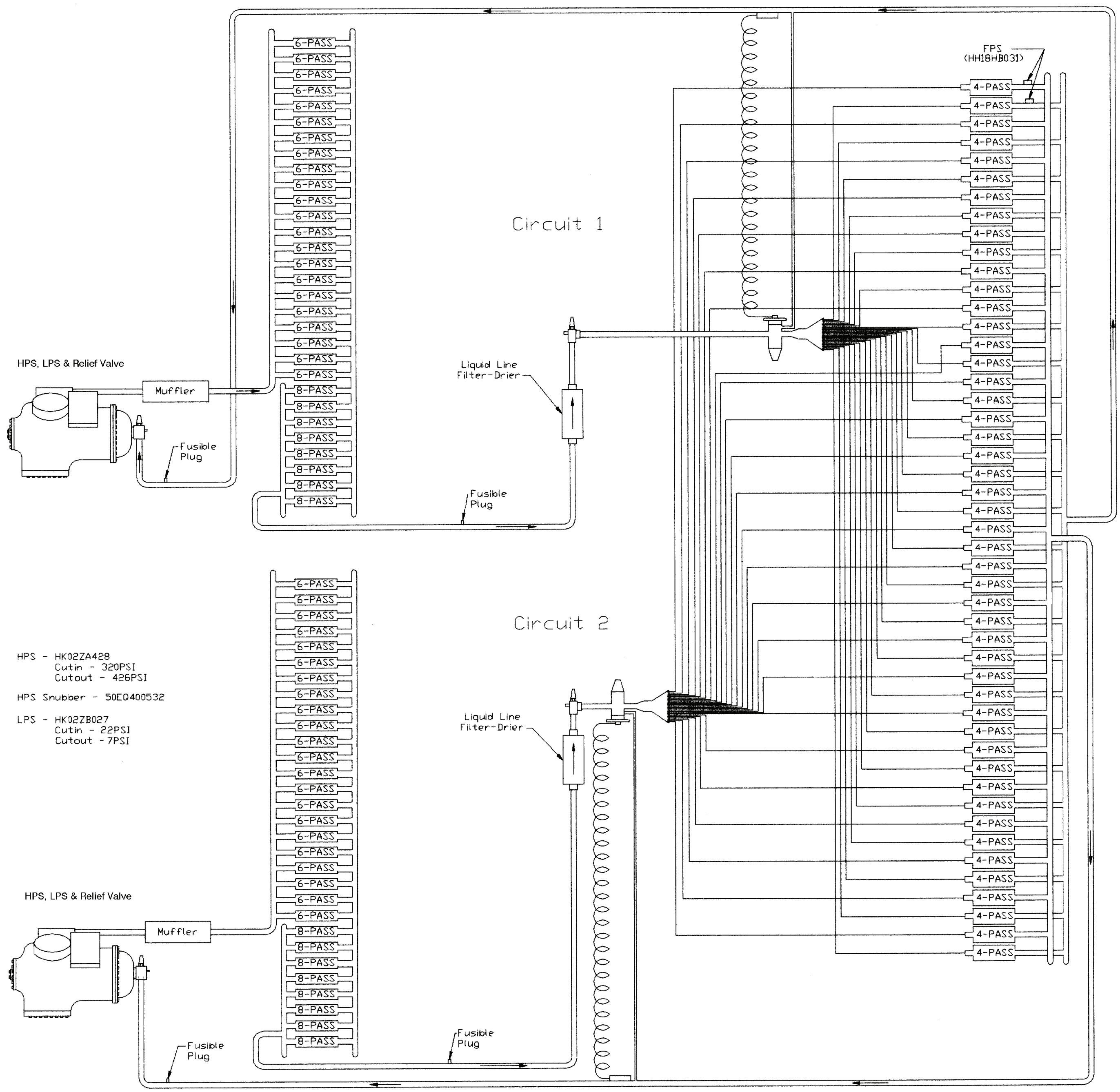
Fig. 87 — Typical Refrigerant Circuiting (48EJ,EK,EW,EY038,044)



LEGEND

FPS — Freeze Protection Switch
HPS — High-Pressure Switch
LPS — Low-Pressure Switch
TXV — Thermostatic Expansion Valve

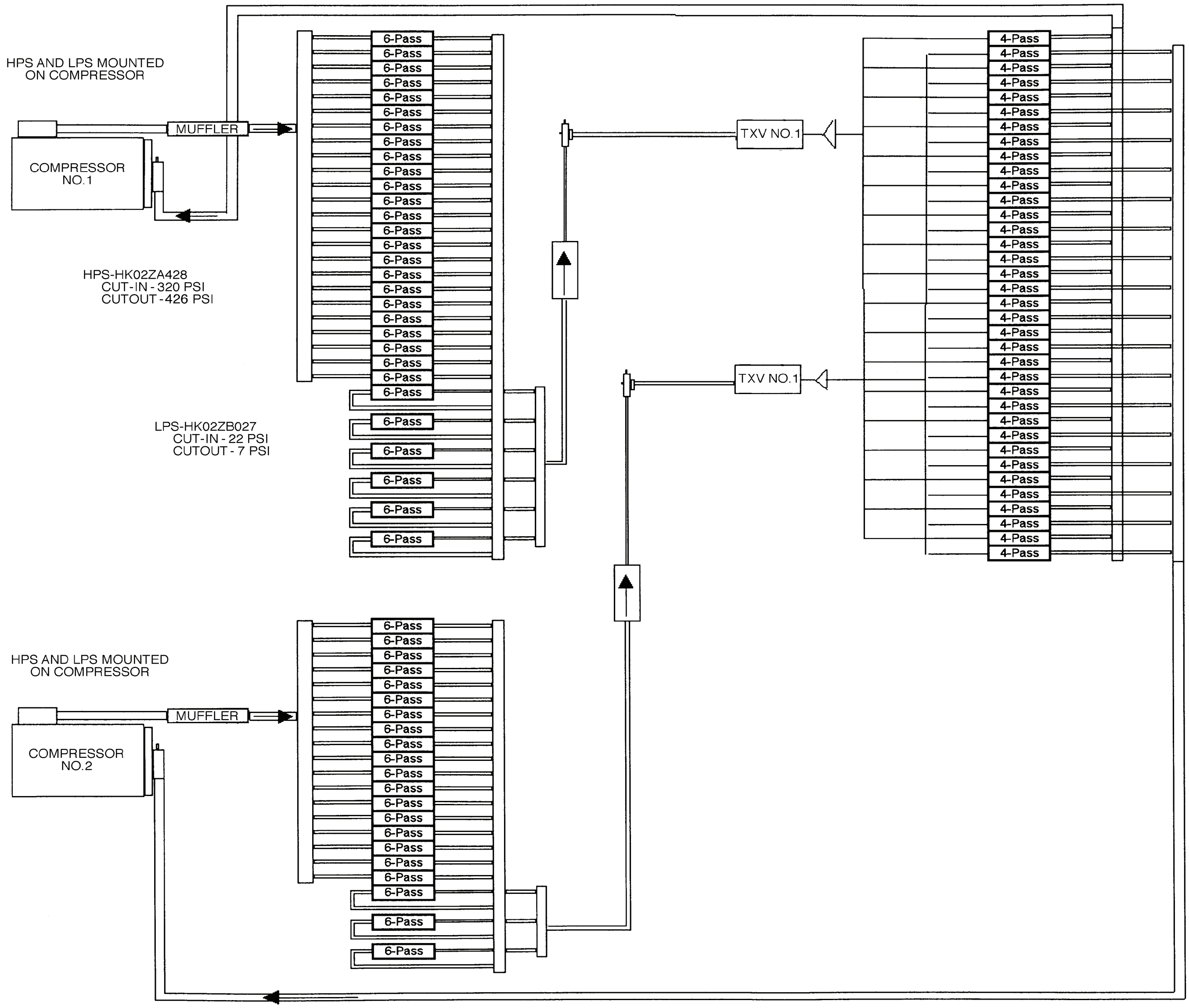
Fig. 88 — Typical Refrigerant Circuiting (48AJ,AK,AW,AY040,050)



LEGEND

FPS — Freeze Protection Switch
HPS — High-Pressure Switch
LPS — Low-Pressure Switch

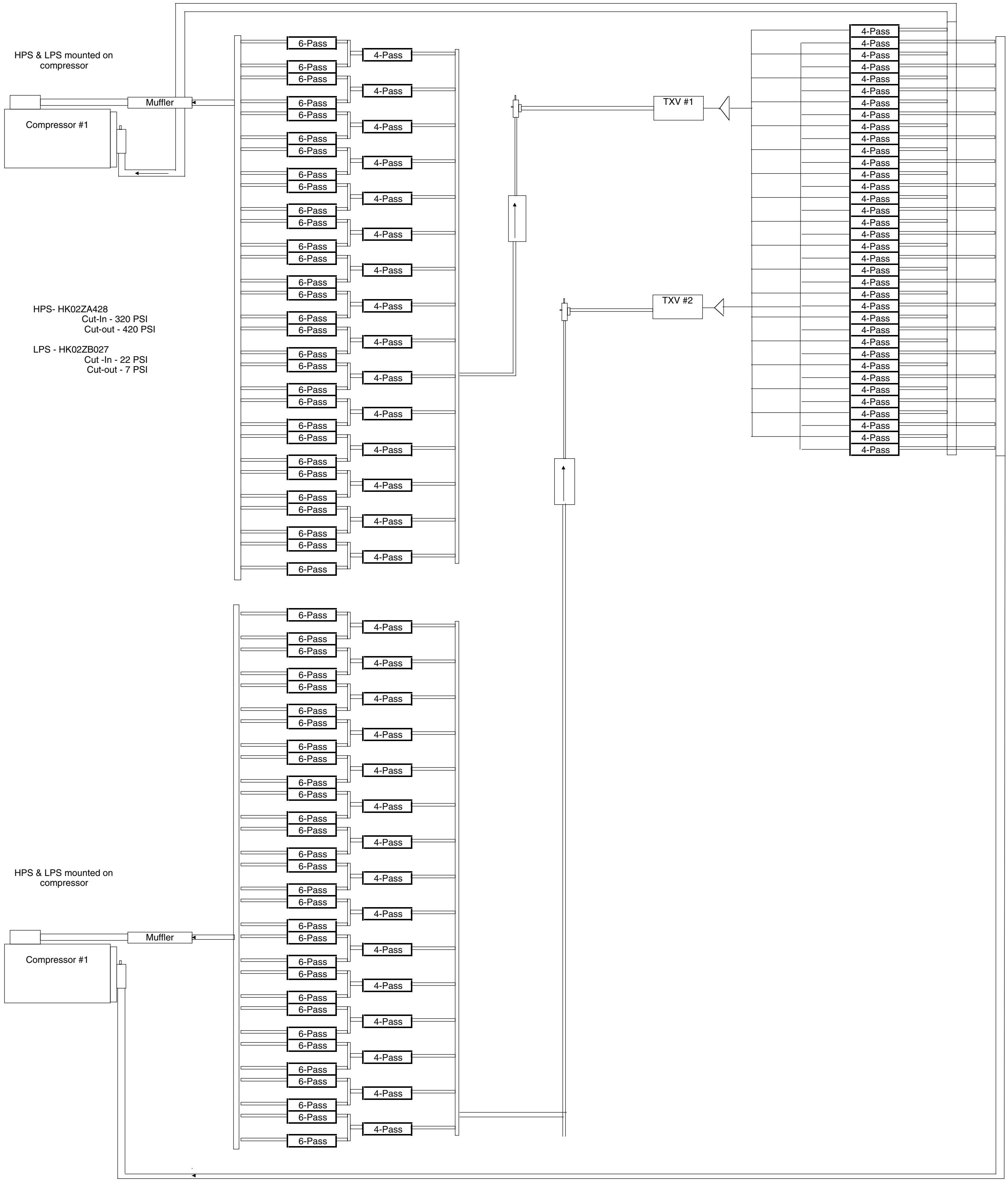
Fig. 89 — Typical Refrigerant Circuiting (48EJ,EK,EW,EY048)



LEGEND

HPS — High-Pressure Switch
LPS — Low-Pressure Switch
TXV — Thermostatic Expansion Valve

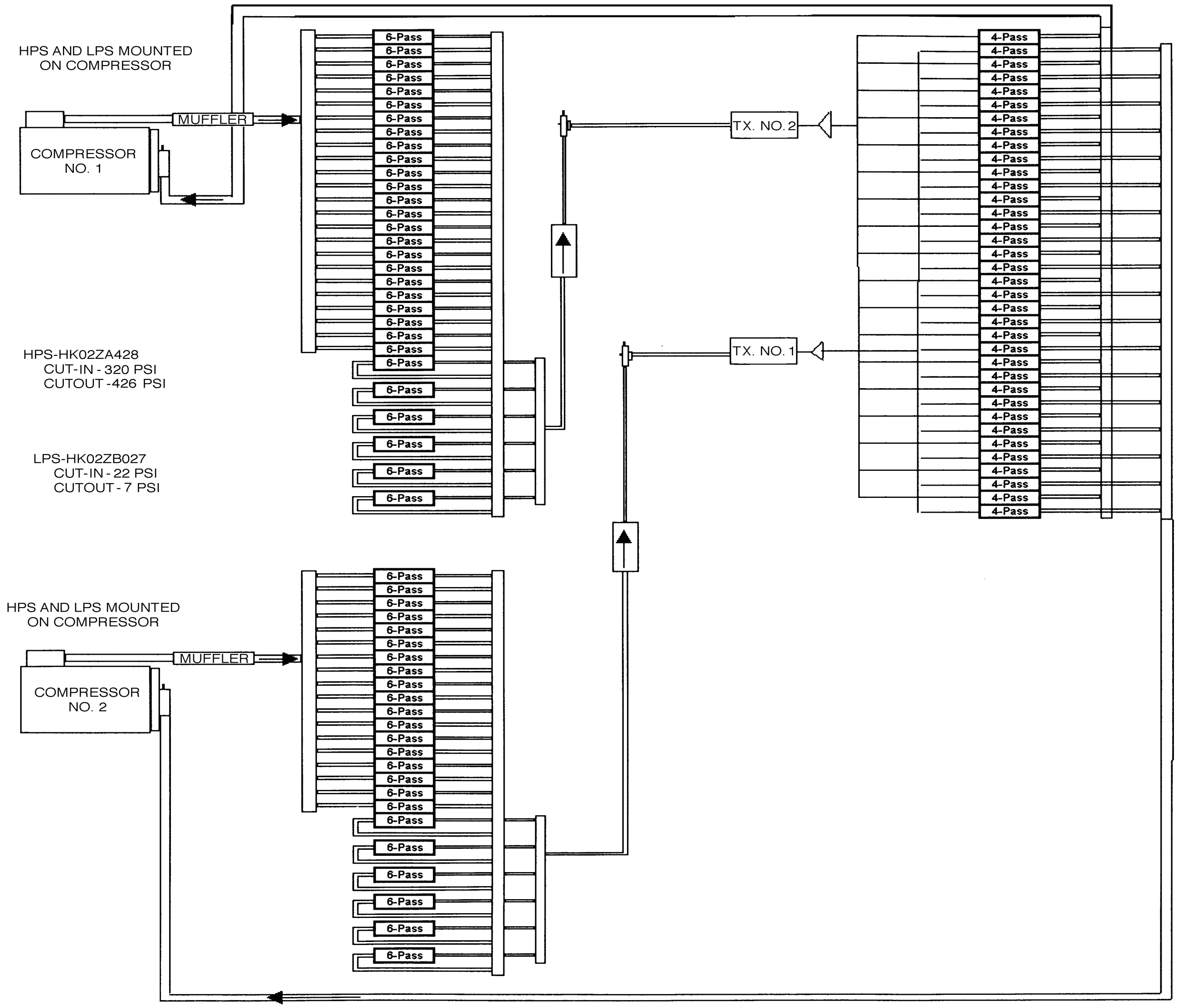
Fig. 90 — Typical Refrigerant Circuiting (48EJ,EK,EW,EY054 and 058)



LEGEND

HPS — High-Pressure Switch
LPS — Low-Pressure Switch
TXV — Thermostatic Expansion Valve

Fig. 91 — Typical Refrigerant Circuiting (48AJ,AK,AW,AY060)



LEGEND

HPS — High-Pressure Switch
LPS — Low-Pressure Switch
TXV — Thermostatic Expansion Valve

Fig. 92 — Typical Refrigerant Circuiting (48EJ,EK,EW,EY064)

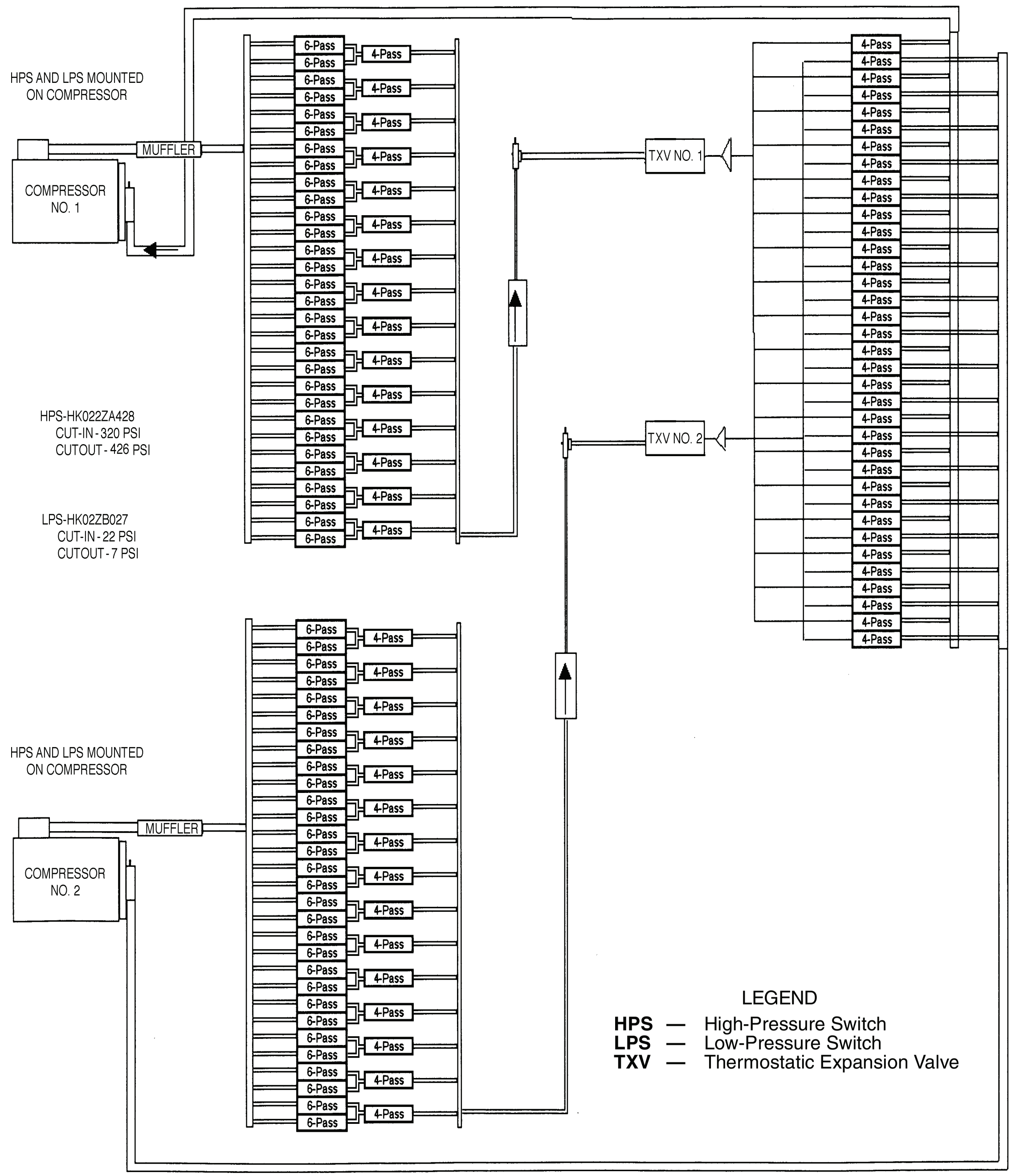
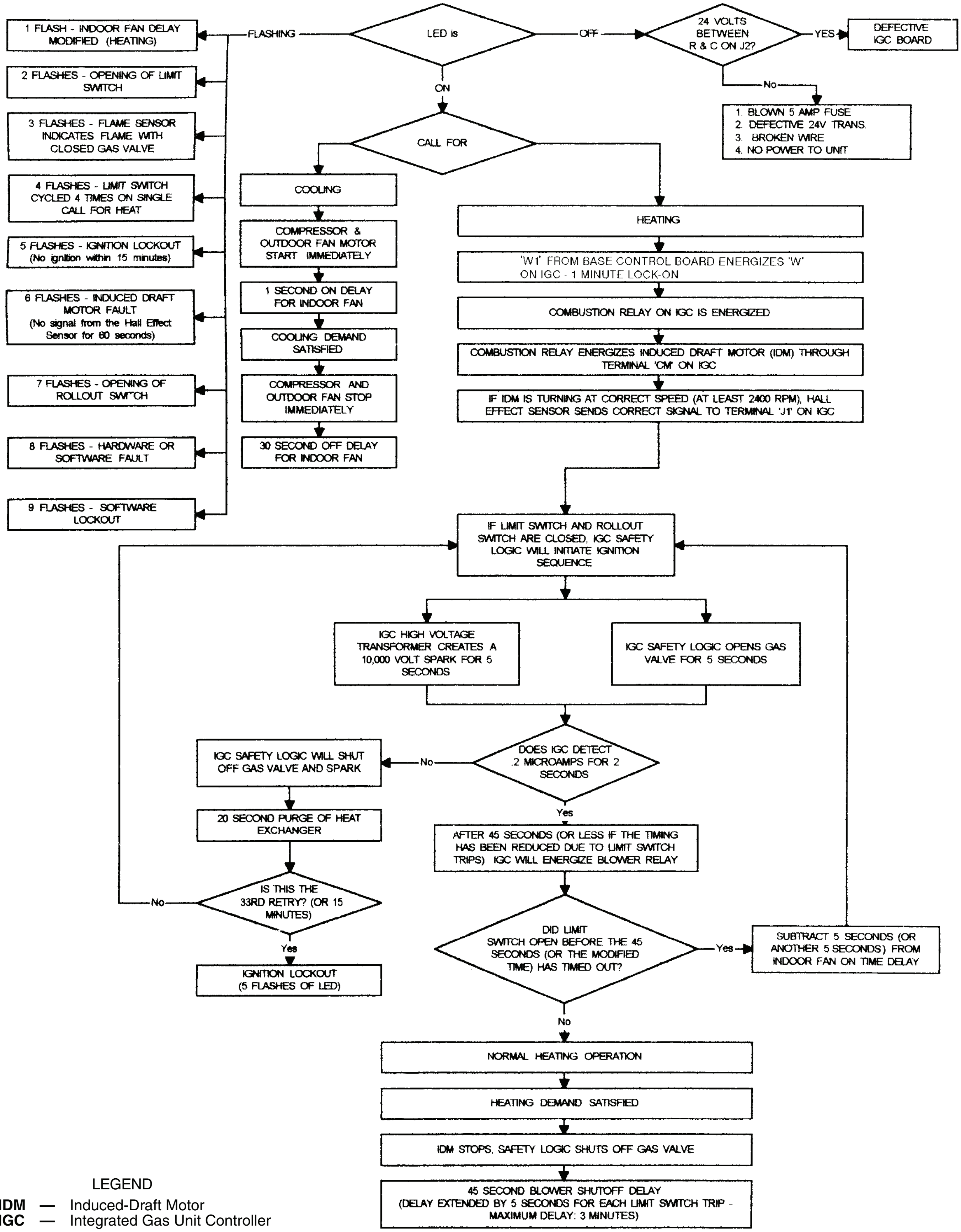


Fig. 93 — Typical Refrigerant Circuiting (48EJ,EK,EW,EY068)



LEGEND

IDM — Induced-Draft Motor
IGC — Integrated Gas Unit Controller

NOTE: Thermostat Fan Switch in the “AUTO” position or sensor-equipped unit.

Fig. 94 — IGC Control (Heating and Cooling)

The alarm codes for the IGC control board are shown in Table 44.

Table 44 — IGC Control Board LED Alarms

INDICATION	ERROR MODE
ON	Normal Operation
OFF	Hardware Failure
1 FLASH	Fan ON/OFF Delay Modified
2 FLASHES	Limit Switch Fault
3 FLASHES	Flame Sense Fault
4 FLASHES	4 Consecutive Limit Switch Faults
5 FLASHES	Ignition Lockout Fault
6 FLASHES	Induced Draft Motor Fault
7 FLASHES	Rollout Switch Fault
8 FLASHES	Internal Control Fault
9 FLASHES	Software Lockout

Diagnostic LEDs — There are 3 LEDs (red, yellow, and green) on the lower right hand side of the control board. The red light is used to check unit operation and alarms. A constant pulse is normal unit operation. A series of quick blinks indicates an alarm. Refer to Table 45 below for a description of alarms. The yellow LED blinks during transmission with the CCN (Carrier Comfort Network). The green LED blinks during transmission with the expansion board.

Table 45 — Control Board LED Alarms

LED BLINKS	ERROR CODE	DESCRIPTION	RESET METHOD	ACTION TAKEN BY CONTROL	TROUBLESHOOTING COMMENTS
1	—	Normal Operation	—	None	The expansion board and control board flash the red LED in one-second intervals when the board is operating properly.
2	HF-13	Compressor 1 Safety	Automatic and Manual	Cooling disabled. Automatic reset after 15 minutes. Manual if repeated 3 times in 90 minutes.	The high or low pressure safety switch for compressor no. 1 has opened for 3 seconds. The error will be cleared and compressor no. 1 will be allowed to turn on in 15 minutes. If the safeties have been tripped 3 times in 90 minutes, compressor no. 1 will be locked out until the control board has been manually reset.
3	HF-14	Compressor 2 Safety	Automatic and Manual	Cooling disabled. Automatic reset after 15 minutes. Manual if repeated 3 times in 90 minutes.	The high or low pressure safety switch for compressor no. 2 has opened for 3 seconds. The error will be cleared and compressor no. 2 will be allowed to turn on in 15 minutes. If the safeties have been tripped 3 times in 90 minutes, compressor no. 2 will be locked out until the control board has been manually reset.
4	HF-15	Thermostat Failure	Automatic	Alarm generated.	The thermostat is calling for both heating and cooling at the same time. The unit will operate on a first call basis and will automatically reset.
5	HF-05	SAT Thermistor Failure	Automatic	Heating, cooling, and economizer disabled.	The supply-air temperature (SAT) sensor has failed. First check for wiring errors, then replace sensor.
6	HF-06	OAT Thermistor Failure	Automatic	NTFC, IAQ purge, economizer, and low ambient DX cooling locked out disabled.	The outside air temperature (OAT) sensor has failed. First check for wiring errors, then replace sensor.
7	HF-03	Space Temp. Sen. Failure	Automatic	Disables unoccupied cooling/heating, CV economizer, and CV cooling/heating.	The space temperature sensor has failed. First check for wiring errors, then replace sensor.
8	HF-12	RAT Thermistor Failure	Automatic	VAV heating disabled.	The return-air temperature (RAT) sensor has failed. Ensure that the unit is a VAV unit. If NOT a VAV unit set DIP switch position 1 to the closed position and reset power. Then check for wiring errors. Finally, replace sensor.
9	SE-05	Loss of Communications with Expansion Board	Automatic	Algorithms in expansion board are bypassed.	Communications between the expansion board and the control board have been interrupted. Ensure that an expansion board is installed and wired using the wire harness supplied with the expansion module. If an expansion board is not used ensure that DIP switch position 3 is in the closed position, and reset power.
10	HF-16	Control Board Failure	None	Control uses default values. (May seem as normal operation)	Generated when hardware has failed on control board. Replace the control board.
		Analog to Digital Conversion	None	All outputs turned off.	
11	HF-17	Expansion Board Failure	None	All outputs turned off.	Generated when hardware has failed on the expansion board. Replace the expansion board.
12	SE-23	Cooling SAT Low Limit Shutdown	Automatic	Alarm generated.	CV operation. When SAT low limits are below range and compressor shut off.

LEGEND

DIP — Dual In-Line Package
VAV — Variable Air Volume

Tables 46-48 show the input and output channel designations.

Table 46 — I/O Channel Designations Base Module — CV

TERMINAL NO.	ASSIGNMENT	TERMINAL NO.	ASSIGNMENT
T1-2	SPT (CCN) — 10KV Thermistor	**T23-25**	Compressor 2 Safety — DI (24 vac)
T3-4	STO (CCN) — 10KV Thermistor	**T24-25**	Outside Air Enthalpy — DI (24 vac)
T5-6	OAT — 5KV Thermistor	**T26-27**	Economizer Pos. — AO (4-20 mA)
T7-8	SAT — 5KV Thermistor	**T28-29**	Heat 1 Relay — DO (24 vac)
T9-10	—	**T30-29**	Heat 2 Relay — DO (24 vac)
T11-12	SAT Reset — AI (4 to 20 mA)	**T31-32**	CV Power Exhaust 1/Modulating Power Exhaust — DO (115 vac)
T13-14	IAQ Indoor — AI (4 to 20 mA)	**T33-32**	CV Power Exhaust 2 — DO (115 vac)
T15-16	IAQ Outdoor — AI (4 to 20 mA)	**T34-35**	Condenser Fan — DO (115 vac)
T17-25	Y1 or Remote Start/Stop — DI (24 vac)	**T36-35**	OFC2 — DO (115 vac)
T18-25	Y2 — DI (24 vac)	**T37-38**	—
T19-25	W1 — DI (24 vac)	**T39-38**	—
T20-25	W2 — DI (24 vac)	**K1**	Indoor Fan Relay — DO (LV)
T21-25	G — DI (24 vac)	**K2**	Compr. 1 — DO (HV)
T22-25	Compressor 1 Safety — DI (24 vac)	**K3**	Compr. 2 — DO (HV)

Table 47 — I/O Channel Designations Base Module — VAV

TERMINAL NO.	ASSIGNMENT	TERMINAL NO.	ASSIGNMENT
T1-2	SPT (CCN) — 10KV Thermistor	**T23-25**	Compressor 2 Safety — DI (24 vac)
T3-4	RAT — 5KV Thermistor	**T24-25**	Outside Air Enthalpy — DI (24 vac)
T5-6	OAT — 5KV Thermistor	**T26-27**	Economizer Pos. — AO (4-20 mA)
T7-8	SAT — 5KV Thermistor	**T28-29**	Heat 1 Relay - DO (24 v)
T9-10	—	**T30-29**	Heat Interlock Relay — DO (24 v)
T11-12	SAT Reset — AI (4 to 20 mA)	**T31-32**	Modulated Power Exhaust — DO (24 vac)
T13-14	IAQ Indoor — AI (4 to 20 mA)	**T33-32**	—
T15-16	IAQ Outdoor — AI (4 to 20 mA)	**T34-35**	Condenser Fan — DO (115 vac)
T17-25	Remote Start/Stop — DI (24 vac)	**T36-35**	OFC2 — DO (115 vac)
T18-25	—	**T37-38**	Unloader 1 — DO (115 vac)
T19-25	—	**T39-38**	Unloader 2 — DO (115 vac)
T20-25	—	**K1**	Indoor Fan Relay — DO (LV)
T21-25	—	**K2**	Compr. 1 — DO (HV)
T22-25	Compressor 1 Safety — DI (24 vac)	**K3**	Compr. 2 — DO (HV)

Table 48 — I/O Channel Designations Expansion Module (Field-Installed) — CV and VAV

TERMINAL NO.	ASSIGNMENT	TERMINAL NO.	ASSIGNMENT
T1-2	—	**T23 and TB2-1**	Fire — Evacuation — DI (24 vac)
T3-4	—	**T24 and TB2-1**	Fire — Smoke Purge — DI (24 vac)
T5-6	—	**T26-27**	—
T7-8	—	**T28-29**	—
T9-10	—	**T30 and TB2-2**	Alarm Light Indicator — DO (24 vac)
T11-12	—	**T31**	Power Exhaust Fire No. 1 — DO (115 vac)
T13-14	—	**T33**	Power Exhaust Fire No. 2 — DO (115 vac)
T15-16	—	**T34**	Power Exhaust Fire No. 3 — DO (115 vac)
T17 and TB2-1	Fan Status — DI (24 vac)	**T36**	Power Exhaust Fire No. 4 — DO (115 vac)
T18 and TB2-1	Filter Status - DI (24 vac)	**T37**	—
T19 and TB2-1	Field Applied Status — DI (24 vac)	**T39**	—
T20 and TB2-1	Demand Limit — DI (24 vac)	**K1**	—
T21 and TB2-1	Fire — Unit Shutdown — DI (24 vac)	**K2**	—
T22 and TB2-1	Fire — Pressurization — DI (24 vac)	**K3**	—

LEGEND (Tables 46-48)

AI — Analog Input
AO — Analog Output
CCN — Carrier Comfort Network
CV — Constant Volume
DI — Direct Input
DO — Direct Output
HV — High Voltage
IAQ — Indoor Air Quality
KV — Kilo-Ohms
LV — Low Voltage
OAT — Outdoor-Air Temperature
OFC — Outdoor Fan Contactor
RAT — Return-Air Temperature
SAT — Supply-Air Temperature
SPT — Space Temperature
STO — Space Temperature Offset
T — Terminal
TB — Terminal Block
VAV — Variable Air Volume

NOTE: All even numbered terminals are negative (–) polarity and all odd numbered terminals are positive (+) polarity.

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Book 1 Tab 1a PC 111 Catalog No. 534-739 Printed in U.S.A. Form 48A,E-1SI Pg 116 107 11-01 Replaces: 48E-6SI

START-UP CHECKLIST

MODEL NO.: ________________ SERIAL NO.: ________________

SOFTWARE VERSION (SEE FIG. 27): ________ TECHNICIAN: ________________

DATE: ________________

PRE-START-UP:

- ☐ VERIFY THAT DIP SWITCH SETTINGS ARE CORRECT
- ☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
- ☐ REMOVE ALL COMPRESSOR SHIPPING HOLDDOWN BOLTS AND BRACKETS PER INSTRUCTIONS
- ☐ VERIFY INSTALLATION OF ECONOMIZER HOOD
- ☐ VERIFY INSTALLATION OF ALL OPTIONS AND ACCESSORIES
- ☐ VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT
- ☐ CHECK GAS PIPING FOR LEAKS
- ☐ CHECK THAT RETURN-AIR FILTER AND OUTDOOR-AIR FILTERS ARE CLEAN AND IN PLACE
- ☐ VERIFY THAT UNIT IS LEVEL WITHIN TOLERANCES FOR PROPER CONDENSER DRAINAGE
- ☐ CHECK FAN WHEELS AND PROPELLERS FOR LOCATION IN HOUSING/ORIFICE, AND SETSCREW IS TIGHT
- ☐ VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED
- ☐ VERIFY THAT SUCTION, DISCHARGE, AND LIQUID SERVICE VALVES ON EACH CIRCUIT ARE OPEN
- ☐ VERIFY THAT CRANKCASE HEATERS HAVE BEEN ON 24 HOURS BEFORE START-UP.

START-UP:

ELECTRICAL

SUPPLY VOLTAGE	L1-L2 ________	L2-L3	________	L3-L1	________		
COMPRESSOR AMPS — COMPRESSOR NO. 1		L1	________	L2	________	L2	________
COMPRESSOR AMPS — COMPRESSOR NO. 2		L1	________	L2	________	L2	________
SUPPLY FANS AMPS	(CV) ________		EXHAUST FAN AMPS		________		
	(VAV) ________ *						

*VAV fan supply amps reading must be taken with a true RMS meter for accurate readings.

TEMPERATURES

OUTDOOR-AIR TEMPERATURE ________ F DB (Dry Bulb)

RETURN-AIR TEMPERATURE ________ F DB________ F WB (Wet Bulb)

COOLING SUPPLY AIR ________ F

GAS HEAT SUPPLY AIR ________ F

PRESSURES

GAS INLET PRESSURE ________ IN. WG

GAS MANIFOLD PRESSURE STAGE NO. 1 ________ IN. WG STAGE NO. 2 ________ IN. WG

REFRIGERANT SUCTION CIRCUIT NO. 1 ________PSIG CIRCUIT NO. 2________ PSIG

REFRIGERANT DISCHARGE CIRCUIT NO. 2 ________ PSIG CIRCUIT NO. 2________ PSIG

- ☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS ON PAGES 93 AND 94.

GENERAL

☐ SET ECONOMIZER MINIMUM VENT POSITION TO JOB REQUIREMENTS

☐ ENSURE DRIVES OPERATE WITH LIMITS OF FAN PERFORMANCE TABLES

HIGH PRESSURE SWITCH SETTING ______________ psig

LOW PRESSURE SWITCH SETTING ______________ psig

MOTOR PULLEY PART NUMBER ______________

FAN PULLEY PART NUMBER ______________

BELT PART NUMBER ______________

BELT SIZE ______________ in.

FILTER QUANTITY ______________

FILTER SIZES ______________ in.

ADDITIONAL NOTES:

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE

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Tab 1a